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Community Health Cell
Library and Information Centre
367, " Srinivasa Nilaya "
Jakkasandra 1st Main,
1st Block, Koramangala,
BANGALORE - 560 034.
Phone : 5531518 / 5525372
e-mail:sochara@vsnl.com

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GOVERNMENT OF KARNATAKA

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FOREWORD

This text book is prepared as per the syllabus framed based on National Policy on Education 1986. The Core Elements and Human values that are stressed in the National Policy on Education are addressed at length in developing lessons.

The Directorate is grateful to all those who have participated in the production of this book.

The Text Books are reprinted after editing and making necessary corrections. The Directorate welcomes suggestions for further improvement of the book.

(M. Jalaja Bai)
Director
Directorate of Text Books
Bangalore - 4.

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UNIT - I

NATURE AND COMPOSITION OF MATTER

If you look around, you may probably see things made of metal, wood, glass and plastic. All these substances are made of matter.

Matter is made up of very small particles called molecules. A molecule is so small that it cannot be seen even with the most powerful microscope.

The three states of matter

Most substances can be classified under one of the three states of matter - solid, liquid or gas under a given set of conditions like temperature and pressure. There is a fourth state of matter called the plasma. Matter in the stars is in the plasma state. A plasma can be produced even on the earth under some special circumstances.

All the molecules in matter are always in motion and are always attracting other molecules. The nearer the molecules get to each other, the more they attract. This attraction between molecules of the same kind is called cohesion. In a solid, the molecules are held together so closely that the forces of attraction between them are very strong and the free movement of molecules cannot

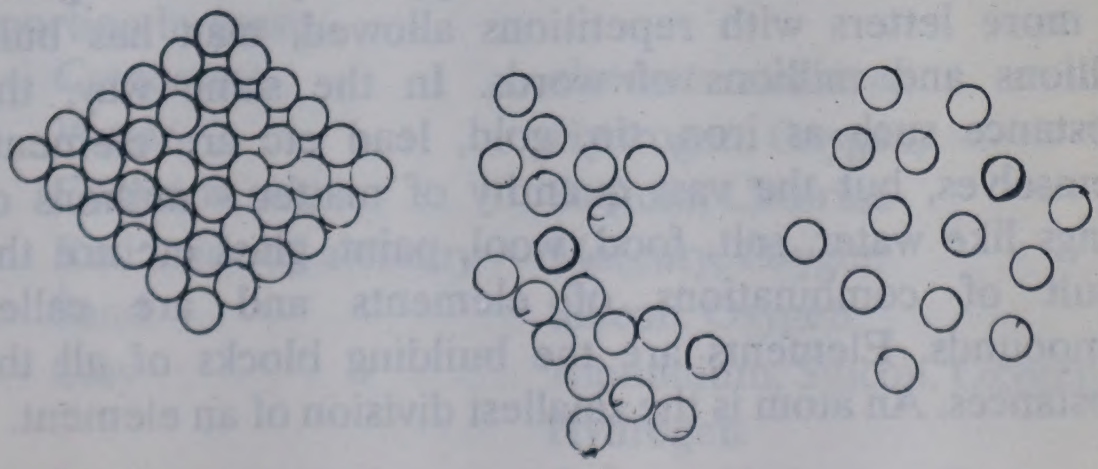

Fig 1: Solid State Liquid State Gaseous State

takeplace. There must be strong forces of attraction between the molecules. A solid has a definite shape, which can be altered only by applying strong force.

In a liquid, the particles are very close together, but they can move apart from one another. The forces of attraction must be weaker. The particles are arranged in clusters. A liquid has no fixed shape. It has a fixed volume and it can be poured easily. The forces of cohesion in a liquid are so weak that they are totally unable to hold up. You can't pile water up in a heap.

The molecules in a gas are moving independently in all directions and at great speeds. They can be pushed closer together. Thus a gas will rapidly spread out to fill any container into which it is placed. A gas has no fixed shape or volume. It can easily be compressed.

Activity - 1 : List out solids, liquids and gases that you come across in your daily life.

Elements, Compounds and mixtures

In English dictionary, you will find hundreds and thousands of words. Some words are big and some words are small, but all the words contain only 26 letters of English alphabet. By using some letters singly or by combining two or more letters with repetitions allowed, man has built millions and millions of words. In the same way, the substance such as iron, tin, gold, lead etc are elements themselves, but the vast quantity of matter - millions of things like water, salt, food, wool, paint, glass etc are the result of combinations of elements and are called compounds. Elements are the building blocks of all the substances. An atom is the smallest division of an element.

Activity - 2 : Take some red oxide of mercury in a dry test tube. Heat it. Observe the upper part of test tube. Silvery globules of mercury will be seen. Test the gas coming out by inserting a red hot splinter. What do you observe? Which is the gas given out?

When Red oxide of mercury is heated it decomposes into mercury and oxygen. These two substances are incapable of being split up into simpler substances.

Element:

An element is a substance that cannot be decomposed into simpler substances.

There are just ninety two naturally occurring elements and eleven artificially prepared. You probably know some of the elements.

Oxygen	Carbon	Iron	Gold
Hydrogen	Sulphur	Silver	Copper

From the elements, all other substances on the earth are made. The number of chemical substances known is about three million.

Compounds:

A compound is a substance produced by the chemical combination of two or more elements in a definite proportion by mass.

Compound	*elements contained*
Water	Hydrogen, Oxygen,
Common salt	Sodium, Chlorine
Red oxide of mercury	Mercury, Oxygen
Sand	Silicon, Oxygen
Clay	Aluminium, Silicon, Oxygen, Hydrogen
Sugar	Oxygen, Hydrogen, Carbon
Sulphuric acid	Hydrogen, Sulphur, Oxygen

It is seen from the above list that oxygen is present in most of the common compounds.

Analysis of earth's crust, the oceans, and the atmosphere reveals that oxygen is the most abundant element on earth accounting for half the total mass.

Mixtures:

Many substances we come across in our daily life are not compounds, but they are mixtures.

Rice and wheat or rice and grams, sugar and salt mixed together form a mixture.

A mixture consists of two or more substances which are mixed together physically, but not chemically combined.

The constituents of a mixture can be easily separated by simple methods.

Solutions and suspensions:

If two substances are mixed to give a mixture in one state, it is called a solution. We say there is only one phase present.

For example - salt dissolved in water.

Water and alcohol mixed together.

The substances making up a solution are called solute and solvent. Salt and alcohol are solutes and water is a solvent.

Activity (1) : Add a little wheat flour in water and stir. What do you observe?

In the activity above, you see a cloudy mixture with solid particles in the liquid. If you leave it for sometime without disturbing it, the particles settle at the bottom. The mixture is said to have two phases. If a mixture has more than one phase, it is called a suspension.

Separating mixtures:

(a) Separating suspensions:

A two phase mixture like sand in water can easily be separated by filtering.

For a fine suspension like clay or mud in water, the same method be used but using a filter paper.

The solid left behind on the filter paper is called the residue. The liquid that passes through the filter paper is called the filtrate.

(b) Separating solution:

(i) A sample of sea water or salt solution is taken in a distillation flask. When heated water boils at about $100^{o}C$ and turns into steam and leaves the flask. It is collected in the receiver and cooled down to give pure water. Salt is left behind in the flask. This process is called distillation.

(ii) A mixture of alcohol and water can be separated by fractional distillation.

(c) Separating a solid mixture:

A mixture of salt and sugar can be separated by the method of solvents.

You have to find a solvent which dissolve one solute but not the other. This results in a suspension and separated by filtration. Alcohol dissolves sugar but not the salt.

Symbols and formulae:

You have learnt that matter is made up of very small particles called molecules. You have also learnt that all the substances are made up of elements.

Dalton's atomic theory was first put forward in 1808. According to this, matter is made up of small, indivisible

particles called atoms. Dalton also invented a number of symbols to represent the atoms of elements which was very laborious. The modern simple way of representing atoms was suggested by Berzelius. This consists generally of using initial letter of the name of the element to stand for one atom of it.

Example:

one atom of hydrogen is denoted by H
one atom of oxygen is denoted by O
one atom of nitrogen is donated by N
one atom of carbon is denoted by C

This rule cannot be applied to all the elements since many elements have the same initial letter. For example Hydrogen and Helium, Carbon and Calcium.

This difficulty has been over come by using, for some elements a symbol consisting of initial letter (as capital letter) together with one small letter from its name.

For example one atom of each of the elements Carbon, Chlorine, Calcium are denoted by C, Cl, Ca respectively.

In the case of metals, the Latin names are used sometimes For example :

Mercury - Hg (Hydragyrum)
Gold - Au (Aurum)
Silver - Ag (Argentum)
Iron - Fe (Ferrum)
Copper - Cu (Cuprum)
Sodium - Na (Natrium)
Potassium - K (Kalium)

From Berzelius system of symbols, is derived a simple method of denoting molecules of a compound or element.

H_2 denotes one molecule of hydrogen (containing two hydrogen atoms)

O_2 denotes one molecule of oxygen (containing two oxygen atoms)

The same method is used to represent the formulae of compounds.

H_2O denotes the formula of water which contains two atoms of hydrogen and one atom of oxygen in combination.

H_2SO_4 denotes the formula of sulphuric acid

HNO_3 denotes the formula of nitric acid

All metallic nitrates are derived from nitric acid HNO_3. They contain nitrate group (or radical) NO_3. In the same way SO_4 sulphate radical, and hydroxyl group OH.

When a group of symbols is common, it is written in a bracket in their formula together with a number to indicate the number of groups

For example - Lead nitrate $Pb(NO_3)_2$ instead of PbN_2O_6

Aluminium sulphate $Al_2(SO_4)_3$ instead of $Al_2S_3O_{12}$

Calcium hydroxide $Ca(OH)_2$ instead of CaO_2H_2

To indicate the number of molecules of a compound, we write

2 HCl - 2 molecules of hydrochloric acid

$3H_2SO_4$ - 3 molecules of sulphuric acid

$10H_2O$ - 10 molecules of water

It is important to note that the number in front of the formula multiplies the whole of the symbols.

The formula of a compound tells

(1) the elements from which a compound is constituted.

(2) the proportion of each atom in one molecule of the compound.

Exercise

1. How do you show that a gas will rapidly spread out to fill any space?
2. Give examples for element and compounds
3. What are the major constituents of air Is air a mixture? If so which is the solute and the solvent. ?

4. Mention the formula for:
   (1) Nitric acid (2) Sulphuric acid (3) Common salt
5. Describe how you would separate a mixture of salt and sugar

UNIT - 2

ACIDS, BASES AND SALTS

OXIDES :

Most of the elements combine with oxygen and form compounds called oxides. An oxide is thus a compound of an element with oxygen.

Water is an oxide of hydrogen. Carbon dioxide (CO_2) is an oxide of carbon. Sulphur dioxide is an oxide of sulphur. Quick lime (CaO) is an oxide of calcium. We often notice brown rust on the surface of an iron article. This is an oxide of iron.

We have oxides of both non metals and metals. Non metal oxides have different properties from those of metal oxides.

Acidic oxides:- Generally non metal oxides are acidic oxides. Their solutions turn blue litmus red.

Activity:- Take a little sulphur powder on a long handled spoon and heat. When it catches fire, introduce it into a gas jar. Sulphur combines with oxygen of air in the jar and forms sulphur dioxide gas.

Now add some water into the jar and shake. The gas dissolves in water. Dip a wet piece of blue litmus paper in the solution. Blue litmus turns red. This shows the acidic nature of the solution. Hence sulphur dioxide is an acidic oxide.

Similarly burn charcoal and red phosphorus in air. Apply litmus test as before.

When acidic oxides dissolves in water they form acids. Example: Carbon dioxide, sulphur dioxide and phosphorus pentoxide dissolve in water to form carbonic acid, sulphurous acid and phosphorus acid respectively.

Basic Oxides:- Generally metal oxides are basic oxides. Their solutions turn red litmus blue.

Activity:- Hold a piece of magnesium ribbon with a pair of tongs and heat. The metal burns brightly in air. Magnesium combines with oxygen of air and forms a white ash of magnesium oxide.

Dissolve this oxide in water. Dip a wet piece of red litmus paper in the solution. Red litmus paper turns blue. This shows the basic character of the solution. Hence magnesium oxide is a basic oxide.

Similarly burn sodium and calcium metals in air. Apply litmus test as before.

When these basic oxides dissolve in water, they form sodium hydroxide, calcium hydroxide and magnesium hydroxide respectively.

Acids:-

An acid is a compound which contains one or more replaceable hydrogen atoms.

Example:-

Hydrochloric acid + Zinc ——— > Zinc Chloride + Hydrogen.

Sulphuric acid + Iron ——— > Ferrous sulphate + Hydrogen.

Acids are formed when acidic oxides dissolve in water.

Acids are also formed when certain compounds other than acidic oxides dissolve in water. For example, hydrogen chloride gas is a compound of hydrogen and chlorine. It dissolves in water to form hydrochloric acid.

Properties of acids:-

1. Acids have a sour taste. Lemon juice contains citric acid. Tamarind has tartaric acid. Hence they both taste sour. You are already familiar with the sour taste of lemon juice and tamarind. We can detect the presence of acids in fruits by their sour taste.

Some acids (and bases) are poisonous. Hence it is dangerous to taste them.

2. Solutions of acids turn blue litmus red.

Dip a wet piece of blue litmus paper in an acid. Observe the colour change.

Using a litmus paper we can easily find out whether a substance is an acid or a base. Hence this is a convenient test for acids and bases.

3. Acids react with some metals liberating hydrogen gas. Metallic salts are produced in the reaction.

Take a few pieces of Zinc in a test tube. Add some dilute hydrochloric acid. The metal reacts with the acid. Evolution of colourless gas takes place. After about a minute, bring a burning paper near the mouth of the test tube. The gas catches fire and burns at the mouth of the test tube. Hence the liberated gas is hydrogen.

4. Acids react with bases and basic oxides and produce salt and water.

Examples:-

Sodium Hydroxide + Sulphuric acid——>Sodium sulphate + Water

Calcium oxide + Hydrochloric acid——>Calcium chloride + Water.

5. Acids react with carbonates liberating carbon dioxide gas. Salts are produced in the reaction.

Take a little calcium carbonate in a test tube. Add some dilute hydrochloric acid. Effervescence take place due to liberation of carbon dioxide.

Calcium Carbonate + hydrochloric acid
------ > Calcium chloride + water + Carbon dioxide

Acids such as concentrated hydrochloric acid, sulphuric acid and nitric acid are highly corrosive i.e., they cause burn on the skin. So we have to take care while using them.

If water is added to concentrated sulphuric acid, much heat is liberated and it makes the acid spurt.

So never add water to the acid to prepare dilute sulphuric acid. Add the concentrated acid to water slowly with continuous stirring.

Bases:-

A base is a compound which reacts with an acid to produce a salt and water onlv.

Bases include metal hydroxides and metal oxides, most of them do not dissolve in water.

Water - soluble metal oxides (bases) are called alkalies e.g. sodium hydroxide, potassium hydroxide, calcium hydroxide and magnesium hydroxide.

A solution of ammonia (NH_3) contains ammonium hydroxide. It contains no metal, but it is also an alkali.

Properties of bases:

1) Bases are bitter to taste.
2) Solutions of bases turn red litmus blue.
   Dip a wet piece of red litmus paper in sodium hydroxide solution and observe the colour change.
3) Bases react with acids and produce salt and water only.

Example:-

Potassium hydroxide + Hydrochloric acid
---------- > Potassium Chloride + water

Magnesium Oxide + Nitric acid---------- > Magnesium Nitrate + Water.

4) Solutions of bases absorb carbon dioxide and form carbonates.

Take some lime water in a test tube. Pass Carbon dioxide gas into it. Lime water turns milky.

Lime water is a solution of calcium hydroxide. It absorbs carbon dioxide and forms insoluble calcium carbonate. Hence lime water turns milky.

Calcium hydroxide + Carbon dioxide------ > Calcium Carbonate + Water

5) Solutions of alkalies are soapy to touch.
6) Solutions of alkalies liberate ammonia gas from ammonium salts.

Sodium hydroxide and potassium hydroxide are caustic i.e. they cause burn on skin. Hence they are called caustic soda and caustic potash respectively.

Neutralization:-

We know that acids react with bases to form salt and water. When right amount of an acid is added to a base (or vice versa), a neutral solution results, that is, the solution is neither acidic nor basic. Acid is said to be neutralised by base. The process of adding right amount of acid to base or vice verse is known as neutralisation.

Activity:- Take about 10 cm^3 of sodium hydroxide solution in a beaker. Add 2 drops of Phenolphthalein indicator. It is just like litmus. It turns pink in an alkali solution. It remains colourless in an acid solution. Hence sodium hydroxide solution becomes pink. Add hydrochloric acid solution using a dropper (or glass tube). Keep shaking the solution. Stop the addition of the acid when pink colour just disappears.

Now the acid is neutralised by base. Salt and water are formed.

To the above neutral solution, add just one drop of

sodium hydroxide solution. The solution becomes pink again (becomes alkaline). To this alkaline solution, add one drop of hydrochloric acid. The pink colour just disappears (becomes neutral).

These changes show that acid removes the property of base and in turn base removes the property of acid in neutralisation.

Neutralisation is one of the methods of preparing salts.

Examples:-

Ammonium hydroxide + Sulphuric acid

----------> Ammonium sulphate + water

Calcium oxide + nitric acid----------> Calcium nitrate + water

Applications of acids, bases and salts.

Acids, bases and salts find wide application in chemical industries. Many of them come into our daily use. They are also used as important laboratory reagents.

1) **Sulphuric acid:** is used in the manufacture of super phosphate, and ammonium sulphate which are fertilizers.

It is also used in the manufacture of dyes, drugs, disinfectants, detergents, explosives, plastics, rayon. It is used in storage batteries. It is used in the manufacture of hydrochloric acid starting from common salt (NaCl)

2) **Hydrochloric acid:-** is used to prepare chlorides. It is used to remove rust from metals before tinning and galvanizing.

3) **Nitric acid:-** is used to make ammonium nitrate and calcium nitrate which are fertilisers. It is used in the manufacture of explosives - TNT, gun cotton, dynamite.

It is used in the manufacture of phosphoric acid and oxalic acid.

It is used in the preparation of nylon and terylene.

4) **Sodium hydroxide:-** (Caustic soda) is used in the manufacture of soap, paper, rayon (artificial silk)

5) **Calcium hydroxide** (slaked lime) is used in the manufacture of caustic soda (NaOH) and bleaching powder, a disinfectant and a bleaching agent for wood pulp, cotton, etc. It is used in softening hard water.

In the laboratory lime water is used to detect carbon dioxide. It is used for neutralising soil acidity in agriculture.

6) **Sodium carbonate** (washing soda Na_2CO_3) is used in laundry. It is the starting material for the manufacture of glass and caustic soda. It is used in softening hard water.

7) **Sodium bicarbonate** (baking soda $NaHCO_3$) is used as baking powder. It is used in fire extinguishers. It is used in medicine to neutralise acidity in the stomach. Magnesium hydroxide and aluminium hydroxide are used in medicine for the same purpose. These are called antacids.

8) **Sodium chloride** (Common salt NaCl) is used for preserving food and in curing meat and fish. It is an essential constituent of our diet.

9) **Potassium nitrate** (KNO_3) is used in the manufacture of gun-powder, in making fire works and in glass industry. It is also used as a fertilizer.

10) **Potash alum** is used in the purification of drinking water.

11) **Copper sulphate** ($CuSO_4$) is used as a fungicide. It is also used in electroplating, dye and calico printing.

12) **Calcium carbonate** (limestone, $CaCO_3$) is used in the manufacture of cement, an important building material. In the pure form it is used in toothpastes and cosmetics.

Exercise

1. What is an oxide?
2. Mention the kinds of oxides.
3. What are the properties of oxides?
4. What is an alkali?
5. What is meant by Neutralisation?
6. List out the uses of acids.

UNIT - 3

HEAT

Heat is a form of energy. Heat is liberated by various sources. The sun is the main source. Burning of fuels and electric current also produce heat. It is also produced when mechanical work is done. Whenever we rub two rough surfaces over each other, we have heat produced by friction. This can also be felt by rubbing your palms against each other. Hammering is another means by which mechanical energy is changed to heat.

Heat can be converted into other forms of energy potential and kinetic energy. We burn coal in the fire chamber of a steam engine and so produce a lot of heat. We use this heat to produce superheated steam in the boiler. Here the heat becomes the potential energy of the steam. This energy is applied to the piston of the engine to drive the wheels. Here the potential energy is changed to kinetic energy. Thus we have a series of energy changes.

Temperature

Heat and temperature are inter-related. Temperature of a body is simply how hot it is or the degree of hotness. We measure the temperature of a body by a thermometer.

Our skin as a thermometer

We make careful observation before we get into a hot bath by immersing our fingers into the water. We can judge whether the water is too hot or too cold or just right. Thus we can judge its temperature with some exactness by touch.

Activity: Take two basins one containing hot water and the other cold. Pour water from each basin in turn and add it to the other until our hands tell us that water in the two basins are equally warm.
Now use a thermometer and measure the temperature of water in the basin. What do you observe?

3.2 Quantity of heat gained or lost by a body.

If we heat a body, it gains the heat and its temperature raises. If we cool it, the temperature decreases. Heat gained or lost by a body depends upon various factors.

Activity: 1: Take two beakers. One filled with 200 ml and the other with 400 ml of water. Heat both the beakers using spirit lamp for about 5 minutes. Measure the temperature of water in each case and compare.

Activity: 2 : Take the same quantity (say 200 ml) of water and oil in two beakers and heat using spirit lamps for about 5 minutes. Measure the temperature of water and oil. Compare the temperatures.

By activity I, we conclude that the temperature depends upon the quantity of water heated, and the time for which heated. If we heat 1 gm of water so that its temperature is raised by $1^{o}C$, the amount of heat is called 1 calorie.

Calorie is the unit for the measurement of the quantity of heat.

Now-a-days Joule is used as the unit to measure the amount of heat. (1 cal = 4.184 Joules).

By activity 2, we know that the temperature of oil raises much more than the water, though the two were heated for the same time. From this we conclude that substances have different heat capacities.

Heat capacity is the amount of heat required to raise the temperature of a substance through $1^{o}C$.

Since oil requires less amount of heat to raise its temperature by $1^{o}C$ than the same amount of water, the heat capacity of oil is less than that of water. Water has the highest heat capacity compared to other substances.

Effects of Heat :

If we heat a substance, its temperature rises, we are familiar with the idea that the ice melts when it is warmed. We also know that heat melts lead and greater head melts iron.

When water is heated, its temperature raises. After some time the temperature remains constant (say $100^{o}C$) When water reaches this temperature, it begins to boil and changes to steam. This is true for all the liquids.

We also know that when water is cooled, its temperature falls. At a particular temperature the water changes to ice.

The above changes occur at some definite temperatures. Therefore we conclude that substances may change their state on heating or cooling.

Boiling point and Melting point

Determination of Boiling point of water.

Some water is taken in a round bottom flask fitted with two holed rubber cork. Through one of the holes pass a bent glass tube and through the other a thermometer. See that the thermometer bulb is just above the surface of water. When the water is heated, there is a rise in temperature. After some time the temperature remains constant even though heating is continued. At this temperature water has changed to steam.

The constant temperature at which water changes to steam is called the boiling point of water.

Latent heat : In the above experiment, the temperature of water becomes constant even though heating is continued. The heat thus supplied is used to change its state, and is called the Latent heat of steam.

The temperature at which a substance changes its state from liquid to vapour is called its boiling point. The boiling point of a substance depends upon the pressure.

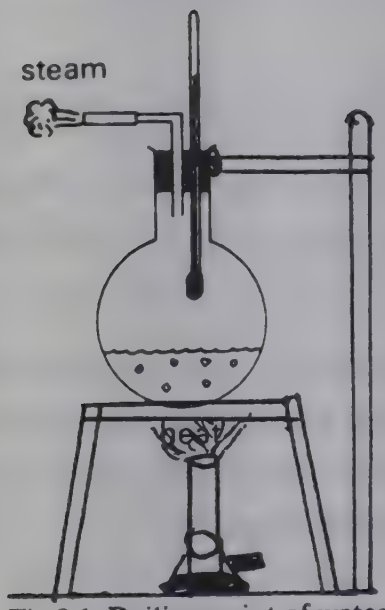

Fig 3.1: Boiling point of water

Determination of Melting point :

Take a few pieces of ice in a large funnel fitted to a stand. Place a thermometer so that its bulb is immersed under ice. The temperature falls down and becomes constant. You will see the ice melting in the funnel. Note down the temperature which is the Melting point of ice.

The constant temperature at which a solid changes its state from solid to liquid is called its Melting point.

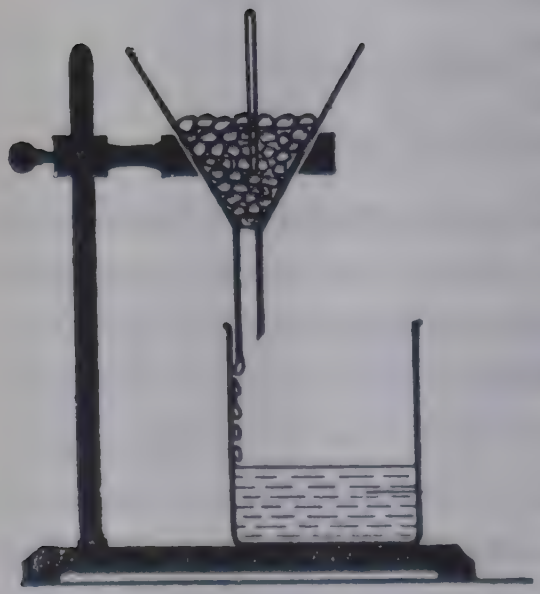
Fig 3.2 : Melting point of ice

Expansion

Heat brings many changes in the objects. It rises the temperature. It changes the State - from solid to liquid or liquid to vapour. These changes can be readily observed. Heat also increases the size of the objects. This effect is called the expansion. Heat expands solids, liquids and gases. The opposite is also true. When the objects are cooled, they contract.

The Ball and the ring Experiment :

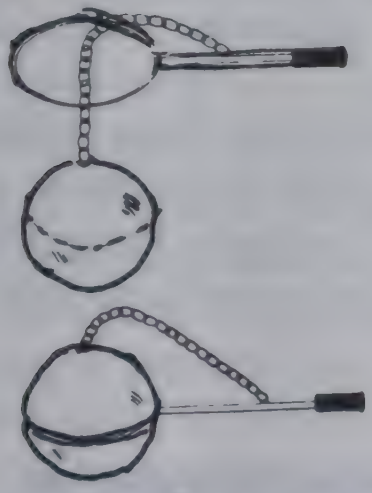

Fig 3.3

The metal ball just passes through a metallic ring. Now heat the ball and allow it to pass through the ring. it does not pass through. This shows that the ball has increased in size.

Now cool the ball and allow it to pass through again. The ball passes through the ring

Activity : Visit a black smith. Observe how he fixes an iron ring on a wooden cart wheel.

Experiment : To show that liquid expands :

Fill a round bottom flask completely with water. Close the flask with one holed rubber cork, through this hole pass a glass tube. Note down the level of water in the glass tube. Heat the water in the flask. The level of water in the glass tube rises.

Activity: Study a mercury thermometer, when the bulb is immersed in hot water, what do you observe.

3.6 Thermometer :

A thermometer is an instrument to measure the temperature of a body. It consists of a long glass tube having a capillary inside it. One end is in the form of a bulb and the other end is sealed. The bulb is filled with mercury. When the temperature is increased the mercury expands and rises in the capillary tube. While graduating a thermometer the temperature of melting ice ($0^{o}C$) is taken as the Lower fixed point and the temperature of boiling water under normal atmospheric pressure is taken as the upper fixed point.

We have different scales. Two important scales are Celsius scale and the Fahrenheit scales.

In a Celsius scale, there are 100 divisions. Each division is called a degree Celsius. In a Fahrenheit scale, there are 180 divisions. Each division is called a degree Fahrenheit. The Lower fixed point is at $32^{o}F$ and the upper fixed point is at $212^{o}F$.

Clinical Thermometer

Fig 3.4 : Clinical thermometer

It is a device to measure the temperature of human body. It has some special features. The graduations are marked from $95^{o}F$ to $110^{o}F$. The capillary tube has a constriction. To measure the temperature, the thermometer bulb is placed in the mouth (below the tongue). The mercury thread will remain fixed and will not go down suddenly due to constriction. This helps to take the reading even after the thermometer is removed from the patient's mouth.

3.7. Transference of heat :

We know that a spoon kept in a cup of hot milk becomes hot. This is because the hot milk transfers some of

its heat to the spoon. Similarly hot body cools down if kept away from the heat, because the hot body transfers some of its heat to the surrounding air.

When cold water is added to hot water, the hot water transfers some of its heat to the cold water. The cold water gains the heat. This goes on till the temperatures of both are the same. Hence we understand that Heat Lost by the hot body is equal to the Heat Gained by the cold body. Heat always flows from a hot body to a cold body.

There are three ways by which transfer of heat takes place. They are conduction, convection and radiation.

(1) Conduction :

You have observed that when one end of a metal rod is heated, it makes the other end also hot after some time. How does heat transfer from one end to the other?

In a solid the molecules are closely packed. When it is heated at one end, its molecules absorb the heat and move to and fro like the bob of a pendulum. These hot molecules in turn cause their neighbouring molecules to vibrate. This process continues till the heat energy is transferred from the hotter part to the colder part. This kind of transfer of heat is called conduction.

Conduction is a process by which transfer of heat takes place through a medium due to vibration of the particles.

Substances which allow heat to pass through them easily are called good conductors of heat. All the metals are good conductors of heat.

Substances which do not allow heat to pass through them are bad conductors of heat.

Example : Wood, asbestos, paper, wool.

Poor conductors such as stones, bricks, plastic, glass are called insulators.

Substances have different conducting capacity.Metals

like silver copper and aluminium are the best conductors of heat.

Convection :

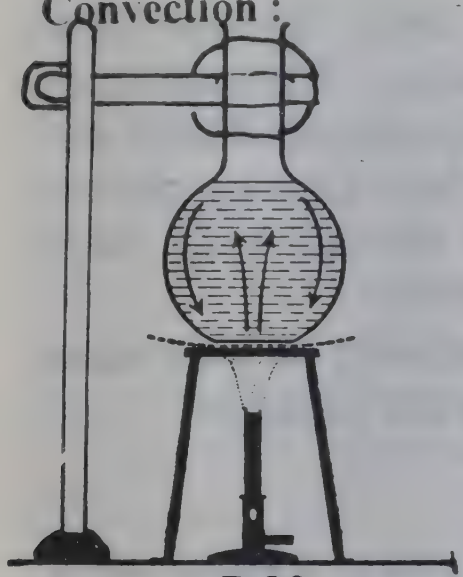

Fig 35

Take some water in a round bottom flask and heat it. You will see that the water particles from the bottom which are heated rises up being lighter. The cold particles from the top move down. This goes on till the entire water in the flask is heated up. The movement of the particles can be well observed if a crystal of potassium permanganate or a drop of ink is added to the water.

In this process, the heat is transmitted by the actual movement of the particles and is called convection.

Convection is the process by which transfer of heat takes place by the actual movement of the particles in the medium.

Convection usually takes place in liquids and gases.

Radiation :

There is another way by which heat is transferred from a hot body to a cold body. This process is called radiation. Radiation does not require any medium for transfer of heat. The heat of the sun reaches the earth by radiation. All hot objects whether solid liquid or gases transfer heat by radiation also.

The amount of heat absorbed by a body depends upon.

(1) The distance from the source.

(2) The colour of the body.

Activity : Hold your hand below a burning electric bulb. What do you observe? How does the heat transfer to your palm from the bulb.
Repeat the experiment by keeping your palm at different distances.

Activity : Take two tin cans, one of which coated with black paint. Fill both the cans with water and keep them in the sun light for some time. You will see that water in the black can is warmer than the other. What do you infer?

3.9. Metals are good conductors of heat. Hence cooking utensils are made of metals like aluminium, stainless steel, copper and other alloys.

Wood, paper, glass, plastic, etc., are bad conductors of heat. These materials are used to make handles of the hot vessels. Materials like bricks, mud, glass, wood, asbestos, etc., are used as building materials for houses. Mercury is used in the construction of thermometer.

Exercise

1. Define 'Calorie'
2. What are the effects of heat?
3. How do you determine the boiling point of water?
4. Describe with an experiment to show that solids expand on heating
5. Mention two features of a clinical thermometer

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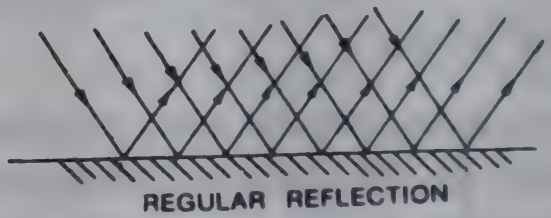
UNIT 4

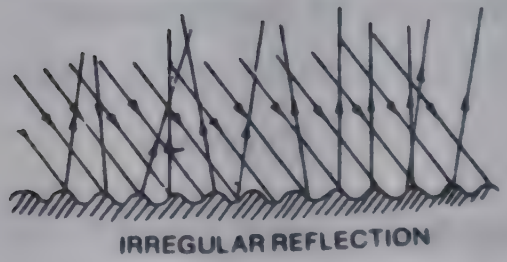
LIGHT

Light makes things visible. Some objects give out their own light and are called self-luminous sources, but most are non-luminous.

Reflection of light.

If light falls on a surface, it is sent back. This is called reflection. If the surface is a rough one, the reflection is irregular. The light is scattered. If the surface is smooth and highly polished, the relfection is regular. Regular reflection obeys certain laws.





Laws of reflection :

A ray of light striking a polished smooth surface MN is called the incident ray AO, and the point 'O' at which strikes is called the point of incidence. OB is called the reflected ray

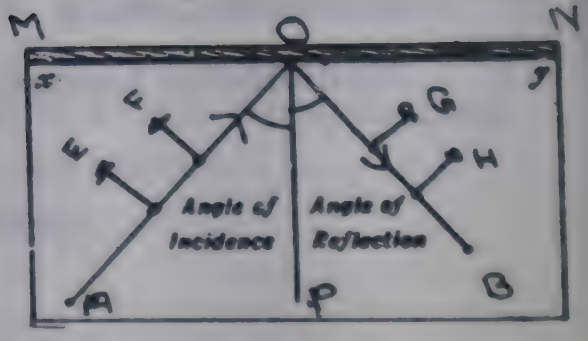


Fig 4.2

and PO, perpendicular to the surface is the normal. The angles ∠AOP and ∠BOP are called the angles of incidence and reflection respectively.

Activity : Place a strip of plane mirror vertically on a paper fixed to a drawing board. Fix two pins E and F in front of the mirror so as to form the incident ray. Fix two more pins G and H such that the images of E and F and these pins, all lie in a straight line. (refer figure above) Place a thin card board on the pins and the mirror and gently press to get the impressions of the pins. What do you observe from it? Now remove the pins. Join the positions of the pins to get the incident ray and the reflected ray. Draw the normal OP. Measure the angles ∠AOP and ∠BOP. What do you observe.

Laws of reflection:

1. Angle of incidence is equal to the angle of reflection.
2. The incident ray, the reflected ray and the normal at the point of incidence, all lie in the same plane.

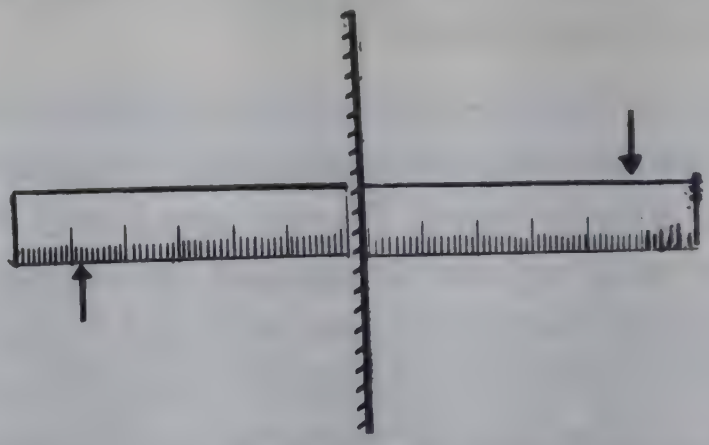
Real and virtual images

Images that can be caught on a screen are called real images. They are always inverted. They are formed in front of the mirror

Images that cannot be caught on a screen are called virtual images. Images formed in a plane mirror are virtual.

They are formed behind the mirror.

Images in a plane mirror (Fig 4.3)



Activity : Place a scale in front of a plane mirror. The arrow in the figure is at a point say 5 cms. Where do you observe the image?

Move the arrow towards the mirror. What do you observe?

1. The image formed in a plane mirror is virtual and erect.
2. The image formed in a plane mirror is as far behind the mirror as the object is in front of it.
3. The size of the image is equal to the size of the object.
4. The image appears to be reversed which is called lateral inversion.

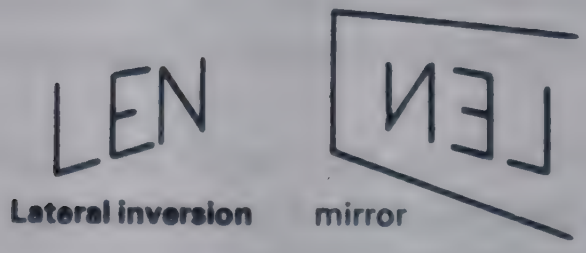


Fig 4.4: lateral inversion.

Uses of Plane Mirror :

Plane mirrors are used as dressing mirrors, as reflectors, in periscopes and Kaleidoscopes.

Spherical mirrors :

Plane mirrors give images that are erect and same size as the object. What about the mirrors that are not plane but curved? Curved mirrors produce different images - both real and virtual, smaller or enlarged and erect or inverted.

The mirrors that are made by silvering the pieces of glass which are the parts of a hollow sphere are called spherical mirrors.

There are two types - concave and convex.

1. Concave mirror : **2. Convex mirror:**

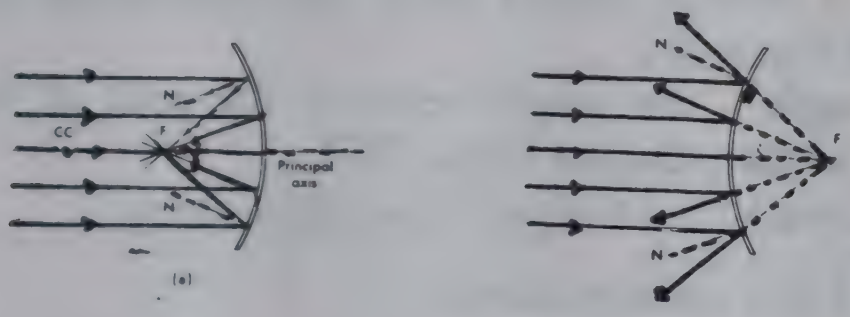


Fig 4.5

1. Concave mirror - The spherical mirror whose outer surface is silvered so that the reflection takes place from the inner surface.

2. Convex mirror : The spherical mirror whose inner surface is silvered so that the reflection takes place from the outer surface.

Centre of curvature, principal axis and Principal Focus.

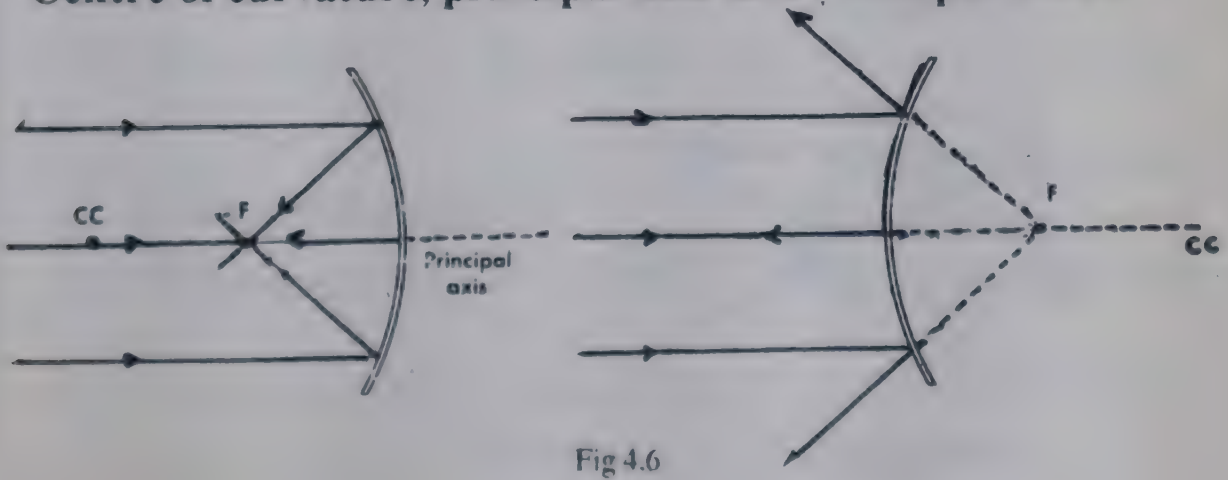
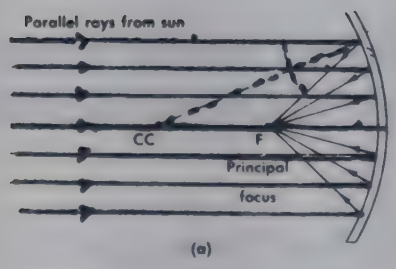


Fig 4.6

1. **Centre of curvature (C)** - the centre of the sphere of which the mirror is a part.
2. **Radius of curvature (R)** - the radius of the sphere of which the mirror is a part.
3. **Pole of the mirror (P)** - the geometrical centre of the mirror
4. **Principal axis** - the straight line joining the pole and the centre of curvature.
5. **Principal focus** - The rays of light parallel and close to the principal axis incident on the mirror after reflection, either pass through a point (concave) or appear to diverge from a point (convex) called the principal Focus (F).
6. **Focal length** - the length between the pole of the mirror and the principal focus. (PF)

The focal length (f) is half the radius of curvature.

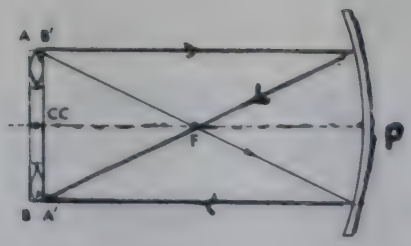
Images formed by a concave mirror :



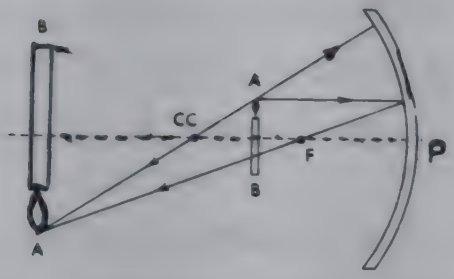
1. When the object is at infinity.

2. Object is beyond C.

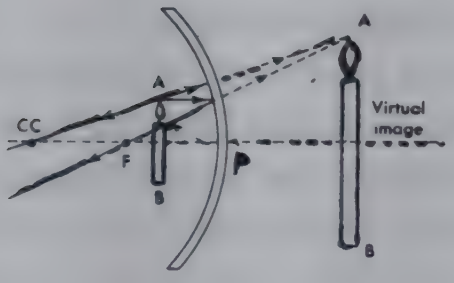
Fig 4.7



3. Object is at C.



4. Object between F & C



5. Object between P & F

	Position		Nature & Size
	Object	*the image*	
(1)	At infinity	At F	Real, inverted and diminished.
(2)	Beyond C	Between F & C	Real, inverted and diminished.
(3)	At C	At C	Real, inverted and same size.
(4)	Between F & C	Beyond C	Real, inverted and enlarged.
(5)	Between P & F	Behind the mirror	Virtual, erect and enlarged.

Image formed by a convex mirror

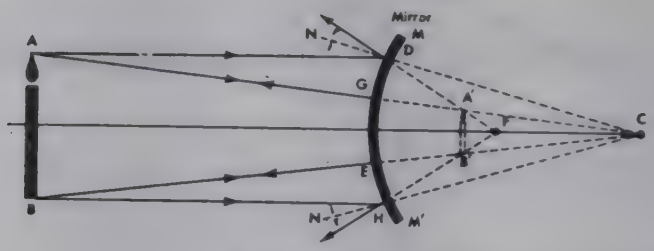


Fig 4.8

In a convex mirror, the image formed is virtual erect and diminished.

Uses : Concave mirrors are used as reflectors in torches, headlights of the motor cars and in searchlights. They are also used in telescopes and as shaving mirrors.

Convex mirrors are used as rear view mirror in motor cars. It gives a clear view of the vehicles coming behind. As the vehicle approaches, the size of the image increases. By looking at the size of the image, the driver can understand whether a vehicle is coming behind or going away from him. It is also used as a reflector in street lamps so as to diverge light over a large area.

Exercise

1. State the laws of reflection.
2. State the nature, position and size of the image formed by a plane mirror.
3. Define radius of curvature & principal focus.
4. Mention the uses of concave mirror.
5. Why is a convex mirror used as a rear-view mirror?
6. Draw a diagram to show the nature, position and size of the image in a Concave mirror when the object is
   (a) between F and C
   (b) between P and F

UNIT -5

SOUND

Every moment you will be hearing so many sounds around you. In the streets, you hear the horn of the vehicles, screech of automobile brakes, loud speakers, shouting etc. Some of the indoor sounds are foot steps, music, radio and television. In the countryside, you may hear the singing of the birds, buzzing of insects, rustle of leaves, murmur of water etc.

Among these sounds some like music, singing of birds rustle of breeze, murmur of water etc are pleasant to hear. The sounds like shouting, horns of automobiles, braying of donkey, thunder etc are unpleasant.

The sound of a railway engine can be heard from a long distance. You can hear your school bell when you are in the playground, but sound produced by a mosquito or a bee cannot be heard from a long distance.

Thus there are various types of sound - some are pleasant to hear and some are not. Some are loud and some are feeble.

How sound is produced :

Activity - 1: Hold one edge of a long metal strip (or a metal ruler) firmly on a table. Pull the free end down and let it go. The free end of the strip moves up and down. You will also hear the sound. What do you observe from this experiment?

Activity - 2 : Take a tuning fork. It has a handle and a pair of prongs. Hold the handle and strike the prong on a rubber pad. What do you observe?

Sound is a form of vibration. The vibrating body disturbs the air and produces sound waves. Just as water

ripples in a tank when you throw a stone. These sound waves go forth in all the directions forming an ever increasing spherical shell whose centre in the vibrating body. When they strike our ears, they vibrate the ear drum.

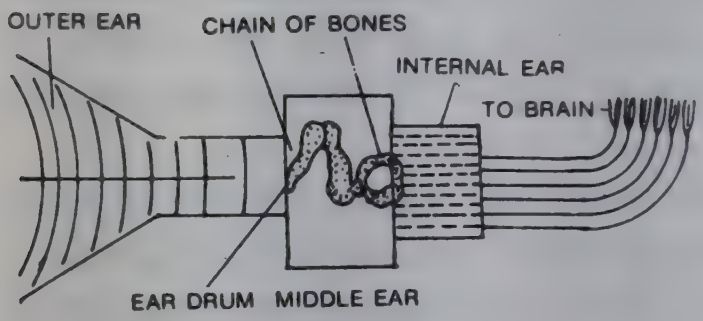


Fig 5.1: Human ear

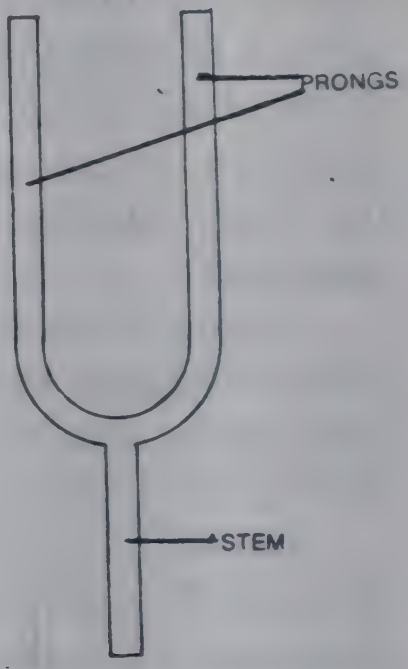


Fig 5.2: Tuning Fork

This vibration is transmitted to the brain and we hear the sound.

Musical Sound and noise

Sudden and irregular vibrations produce noise, whereas regular and even vibrations produce a musical tone or a pitch. Anything that vibrates regularly between 40 vibrations per second and 10,000 vibration per second will produce a musical note.

Tuning forks are marked as 200, 300, 400 and so on. It means when you strike the fork the prongs vibrate so many times per second.

The human ear can hear vibrations from about 20 per second all the way up to about 20,000 vibrations per second.

Some animals like dogs, leopards, monkeys and deer can hear vibrations beyond 20,000 per second.

Musical Instruments

The musical instruments can be classified into three groups.

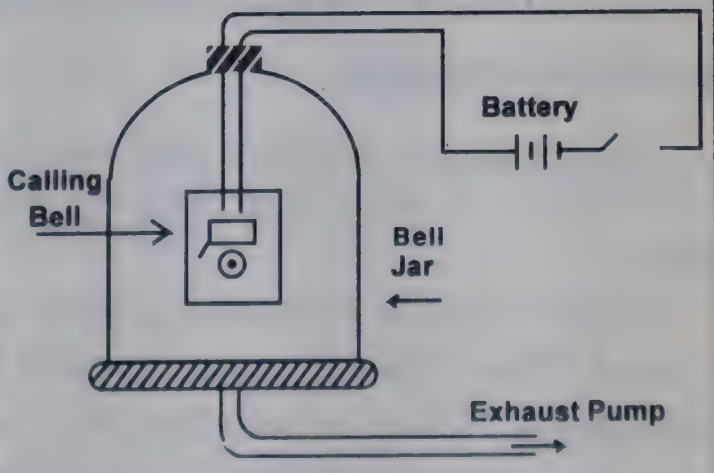
1) percussion instruments can be classified into three groups.
2) wind instruments such as flute, nadaswaram, shahnai
3) string instruments such as violin, veena, sitar, etc.

Quality of sound distinguishes the type of instrument giving a musical sound or enables us to recognise a familiar voice. Quality is due to the wave form of the vibration. Quality distinguishes a flute from a stringed instrument instantly even though they may be playing the same note. It also distinguisheds a person from another by the voice.

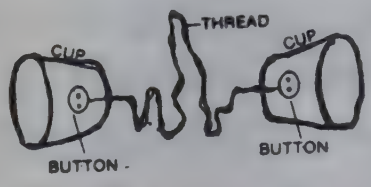
Propogation of Sound :

When a body vibrates, it produces sound waves. These waves travel far and wide in spherical shells. A material medium like air is necessary for the transmission of sound. Without it there can be no sound.

Activity :1 : An electric bell is hung inside a glass jar connected to an air exhaust pump. When the current is passed the bell rings. When the pump is worked and the air is removed the sound gradually becomes fainter and fainter though you see the hammer striking the gong. What does this experment show?



Activity - 2 (Simple telephone)
Take two card board boxes. Cut off one face of each of the box. Make a hole at the centre of each box. Pass a long thick thread (about 50 metres) through the holes. Fix button to each end to hold the thread. You can now draw the boxes apart so that the thread gets stretched and talk to your friend at the other end.



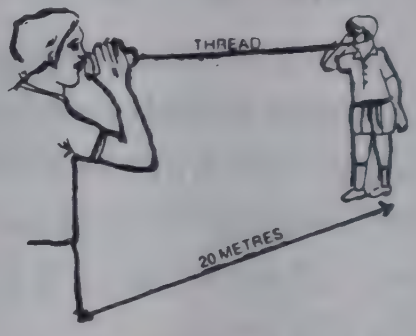


Fig 5.4

Speed of sound

Sound travels in air at a slow rate of about 1200 km per hour(at about 30°C). Compared to the speed of light, sound travels more slowly than light. That is the reason why you see the lightning first and then hear the thunder.

Reflection of Sound

When sound strikes a hard surface such as a wall, rock or a cliff, it is reflected. The reflected sound is called an echo.

The sensation of sound persists on the ear for 1/10 of a second. Meanwhile if another sound follows, the ear cannot distinguish. Hence to hear an echo, reflecting surface should be at a minimum distance of 16.6 metres from the observer.

In a small room, we cannot hear an echo since the

original sound and the reflected sound falls on the ear within 1/10 of a second.

If the sound is reflected several times, you can hear multiple echos just as in the whispering gallery in Golgumbaz.

Noise Hazards :

Whereas sound is essential for communication, noise is unpleasant to hear. It is a source of hazard and harmful to the ear. Nowadays the use of loud speaker in the streets is really a nuisance. Use of fire crackers during festivals not only pollutes the air, but also harms the ear. Some automobiles also contribute to the noise hazard.

It is necessary to control the noise pollution. Some steps are given below.

1) to avoid excessive use of loud speaker in the streets
2) to avoid fire crackers of high intensity
3) Drive against harsh shrill loud or alarming noise.

Exercise

1. How sound is produced?
2. A tuning fork is marked 320. What do you mean by it?
3. What is noise? What are its effects?
4. How do you classify the musical instruments? Give examples for each.
5. Describe how you would show that a material medium is necessary for the propagation of sound.

UNIT - 6

ELECTRO-STATICS

The ancient Greeks noticed that amber has a strange power to attract small bits of paper or straw when rubbed with fur. William Gilbert made a systematic study of amber and its property of attraction when suitably rubbed. He showed that this is common to many substances such as glass, sealing wax, diamond and sulphur. The Greek equivalent word for amber is electron and the word "Electricity" was introduced.

You must have observed sometimes that your clothes cling to you when you take them off. You also see sparks and crackling sound. This is due to the electricity.

When a glass rod is rubbed with silk, and brought near small bits of paper or straw, they are attracted. The glass rod is said to be "charged."

Activity 1 : Take an ebonite rod and rub with wool. Bring it near small bits of paper. What do you observe?

Types of electric charges

Activity 2 : Charge a glass rod (A) by rubbing with silk cloth, and suspend it freely. Charge another glass rod (B) in the same way. Bring it near A. What do you observe; Now bring a charged ebonite rod near A. What do you observe?

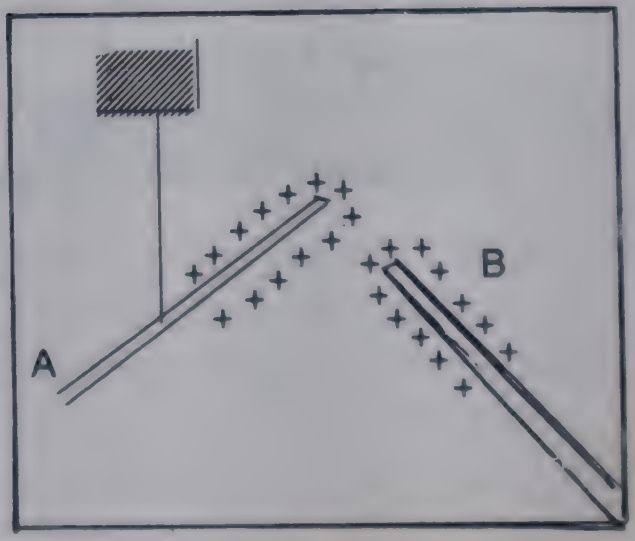


Fig 6.1

From the above, you understand that there are two kinds of charges - that produced by glass called 'positive' and that produced by ebonite called 'negative.'

Electric charges of the same kind whether positive or negative repel each other, but unlike charges attract each other.

Transfer of charge.

Activity 1: Take a rectangular sheet of paper and roll it into a hollow cylinder. Suspend it by a silk thread. Bring an ebonite rod rubbed with wool near the cylinder. What do you observe?

Activity 2: Suspend a pith ball coated with metallic paint by a silk thread. Bring an ebonite rod rubbed with wool near the pith ball. What do you observe?

There is attraction between a charged body and the uncharged body.

When the uncharged body comes in contact with the charged body, some of the charges (negative charges called electrons) are transferred to the uncharged body. You also notice that the uncharged body gets repelled because both of them will have the same kind of charge.

Electroscope

An instrument for detecting and finding the kind of electric charges is called an Electroscope.

Two thin gold metal leaves are attached to a metal cap. It is enclosed in a glass case. The electroscope can be charged positive or negative.

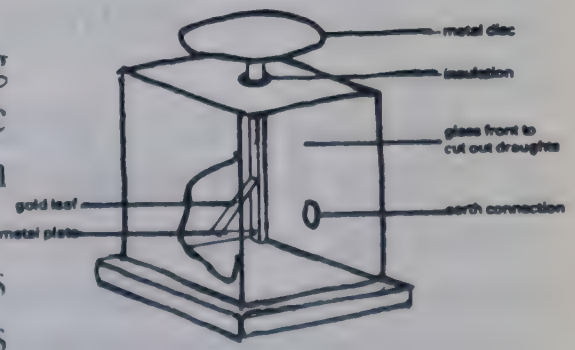


Fig 6.2

Charging an electroscope :

If the metal cap of the electroscope is touched with a glass rod rubbed with silk (positive charge), the leaves move apart. This is because both the leaves get like charges.

Activity 3 : Take an ebonite rod and connect it to metal cap of an electroscope using a silk thread. Charge the ebonite rod by rubbing with wool. What do you observe?

Thus we may conclude that silk does not allow electric charges to flow through them, whereas copper or aluminium allow the charges to flow through them.

Substances which allow the electric charges to flow through them are called conductors.

Substances which do not allow the electric charge to flow through them are insulators.

Conductors -

Aluminium, copper, gold, silver, nickel, Iron, etc.,

Insulators -

Amber, glass, mica, silk, paper, etc.,

The kind of electricity in which charges build up on insulating materials is static electricity. It is also sometimes called frictional electricity because it is produced by rubbing.

Lightning is due to the static electricity. A cloud is made up of tiny water drops. When these water droplets are rubbed and pulled about, they are charged with electricity. Suddenly the electricity charge in one part of the cloud is attracted to a charge in another part of the same cloud or in another cloud. As the charges flow through the air, it causes the air to glow. It is lightning. An electric current is a flow of electrons. The current (electricity) and static electricity are

essentially the same, but one consists of moving charges and the other of stationary charges.

Activity: Take two long rubber balloons. Blow them up and tie knots at the ends. Take them in a dark room and rub back and forth against your pant, then bring them together so that they almost touch. What do you observe? Can you hear a faint crackling sound?

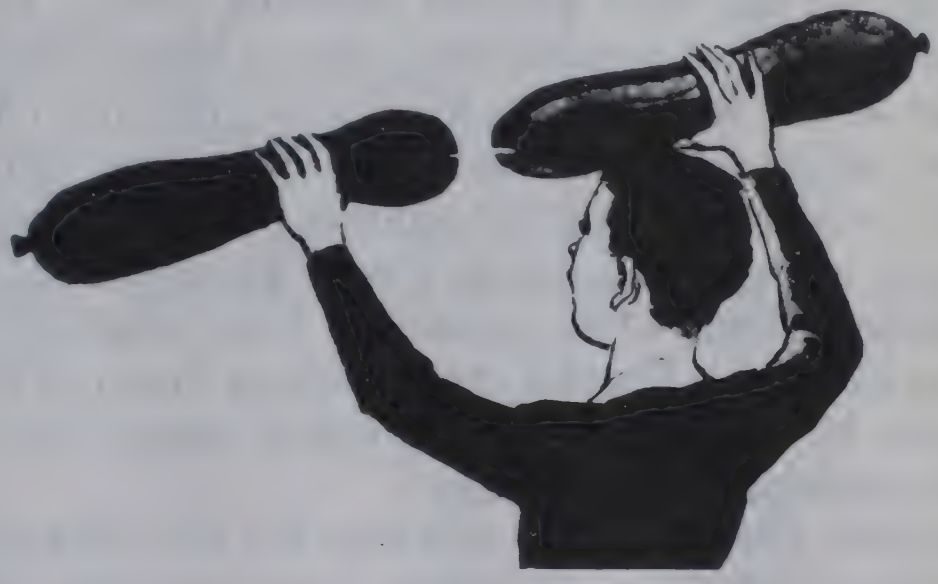


Fig 6.3

Exercise

1. How do you electrify an object?
2. How do you find whether a given body is charged or not?
3. How many kinds of charges are there?
4. Draw a diagram of an electroscope and label its parts.
5. What is the difference between conductors and insulators?

UNIT - 7

ENERGY

Energy:

Energy exists in two distinct forms, potential and kinetic. Potential energy is stored up energy. When you wind up a clock, you do a certain amount of work. The mechanical work you do is transferred to and stored up in the spring and the clock acquires potential energy. Water stored in a high level tank has the potential energy because the water let out from it flows to a greater distance (As in the water supply system in the towns). When you throw a stone up, it reaches a height and acquires potential energy.

Kinetic energy is the energy a body possessed because of its motion. River water or moving water displaces the objects in its path and even it carries objects from one place to another. Moving water posseses kinetic energy. Moving wind also possesses kinetic energy.

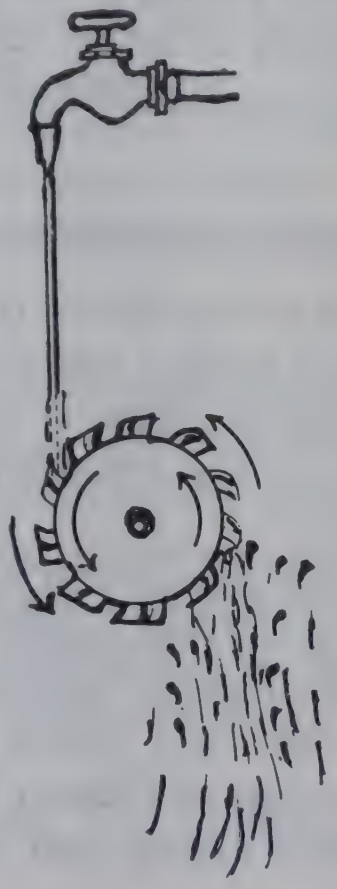
You have already studied that heat is a form of energy. Heat produces energy and energy produces heat. Heat makes steam which runs the steam engine.

The sun is the source of heat and light. All living things on the earth live and move because of the energy of the sun. You get energy from food. Fruits, vegetables, meat - all must have stored up or potential energy. Fruits and vegetables grow due to sunlight. The animals eat the plants. So indirectly the meat that we eat is the suns' stored up energy in the form of fats and proteins. Fuels like wood, coal and oil that produce necessary heat comes from sunlight that has been stored up for years and years in the form of chemical energy.

7.2. (1) Energy can be transformed from one form to another:

When you wind up a clock, the mechanical work you do is transferred into Potential Energy When the clock starts to run the Potential Energy will be transformed into Kinetic Energy.

Activity : Fig.7
Store water in a tank at a certain height fitted with a tap at the bottom. Allow the water to fall on a peddle wheel. The wheel turns.



2. Water when falls from a height has enormous potential energy. Water from the falls is lead into turbine pits and made to rotate huge wheels, thus transforming Potential Energy to Kinetic Energy. The huge rotating wheel turning between poles of magnets, produce an electric current and thus the mechanical energy from the wheels is changed into electrical energy.

Activity : Study how an electric current is produced in a bicycle dynamo.

Gobar gas, solar energy, wind energy are called the renewable sources. It is necessary that a judicious use of non renewable sources of energy need be encouraged.

1. Use renewable sources instead of non-renewable.
2. Use pressure cookers or cover the vessel, while cooking on LPG.
3. Motor car or two wheelers are to be used whenever needed.
4. Replacement of old defective engines by new engines to save fuel consumption.
5. Switch off Automobile Engines when not running.
6. Solar cookers/solar heaters/gobar gas may be used to save LPG.

Exercise

1. What is potential energy? Give two examples.
2. What is Kinetic Energy.? Give two examples.
3. What are the different forms of energy?
4. How can friction in machines be minimised?
5. what are the renewable and non renewable sources of energy?
6. How can we solve the energy crisis?

UNIT - 8

ORGANISATION OF LIVING BODY

We see variety of organisms around us like small herbs, trees, ants, elephants, etc. All these have different parts.

Plants have roots, stems, leaves and flowers. Animals have limbs, heads and other parts. Each part performs a particular function.

The roots absorb water and minerals and fix the plant in the soil. The stem upholds the branches and other parts to air and sunlight. The leaves manufacture food.

The beak of a bird helps in getting the food and the wings help in flying.

These parts are called organs. An organ can perform a function because its structure is suitable for that function. A group of organs like mouth, stomach and intestines take up a definite function like digestion. Such groups of organs are called organ systems. Major functions of the body are performed by a combination of organs and organ systems.

Activity:- Make a list of the organ systems in man and match them with their function.

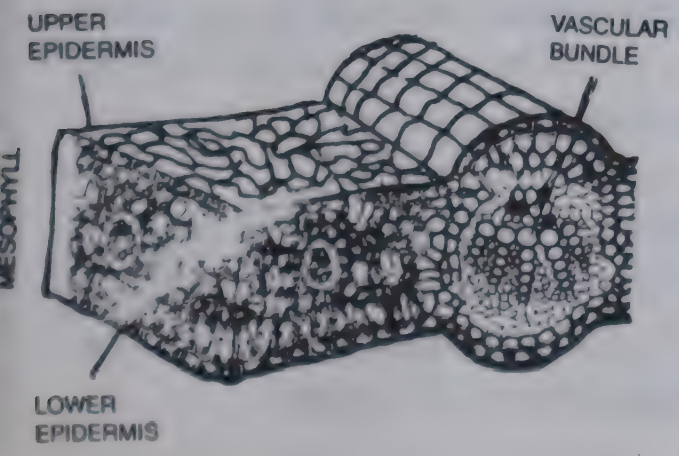


Fig: 8.1. Section of a Leaf

An organ is further made up of smaller units. Observe carefully the fig.8.1.

You will find different layers like upper layer, middle layer and lower layer. Do you observe anything else?

There are different types of 'cells'. Groups of

similar cells take up a particular function, for example, the upper layer protects the leaf. The dotted cells take up the function of preparing food. Such groups of similar cells which carry out similar function are called tissues.

In man there are muscle tissue, bone tissue, nerve tissue and so on. The muscle tissue is made up of muscle cells. The nerve tissue is made up of nerve cells.Thus we find that the plants and animals we see around us are made up of many cells. They are called multicellular organisms.

The cells are the building blocks of multicellular organisms. The cells are placed into different levels of organisation. The cells are organised into tissues, tissues into organs and organs into organ systems. Finally the organism functions like an individual with perfect coordination of tissues and organs.

It is surprising to find that some single cells function as an organism. The cell can perform basic life activities like respiration, digestion, growth and reproduction. They can live independently like multicellular organisms. They are called single celled organisms. Ex. Amoeba.

Activity:- Observe a drop of pond water under the microscope. Find out if you can identify any of the single celled organisms given in the Fig. 8.2

Most of the single celled organisms cannot be seen with naked eyes. You can see them by using an instrument called microscope. A microscope magnifies the tiny organisms many times.

Have you seen a jeweller or a watch repairer using a hand lens? It is a simple microscope. To-day we have several kinds of microscopes. The common biological or laboratory microscope is a compound microscope.

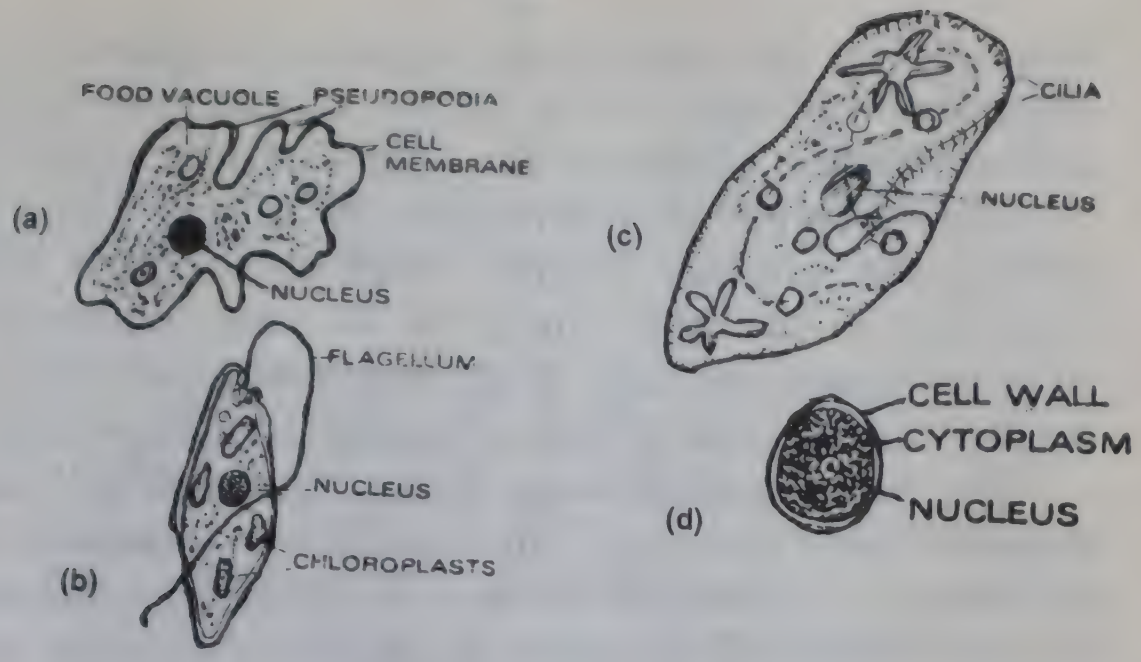


Fig 8.2 Single Celled Organisms
(a) Amoeba (b) Euglena
(c) Paramecium (d) Yeast

Activity: Study the parts of compound microscope. Learn to use it with the help of your teacher. Find out where the specimen is kept and how microscope slides are prepared. Make a list of the different types of modern microscopes and collect their pictures.

Robert Hooke an English scientist observed a slice of cork under a compound microscope where a set of lenses were used. He observed honeycomb like structures. He called them 'Cells.' Actually he saw the walls of the dead cells.

Most of the organisms we see are made up of large number of cells. Some are just a group of cells and loosely grouped without integration into tissues (sponges), some are group of cells arranged into colonies (volvox) filaments (spirogyra). In large organisms like mango tree, dog and man the various functions performed by single cells are shared by many cells. The cells are specialised for different

types of work. The multicellular organisms originate from a single fertilized egg cell.This further divides and the cells differentiate into various tissues, organs and organ systems.

The invention of microscopes of various kinds has enabled the scientists to know more about single celled organisms. It has also proved to be very important in studying tissues and cells. They have discovered that cells are the structural and functional units of living organisms.

The cells are of different shapes. A muscle cell looks different from a nerve cell. The shape of a cell is suitable for its function. A nerve cell will have a long tail like extension so that it can send messages to the brain or other parts quickly.

Even though the cells look different in shape and size, all cells have many similarities in their structures. Observe the figure 8.3. You will see many parts common for both plant and animal cells.

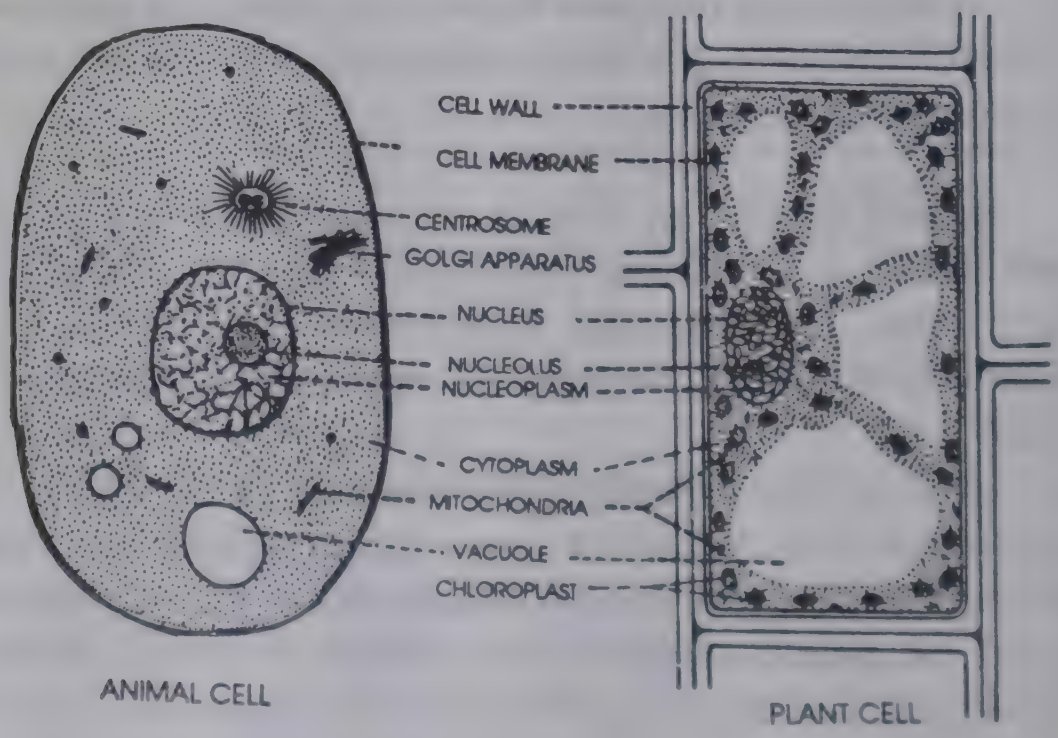


fig. 8.3 Plant And Animals Cells.

The structure and functions of a living cell can be compared to a factory. Many new substances are manufactured. At the same time complex substances are broken down into simple substances.

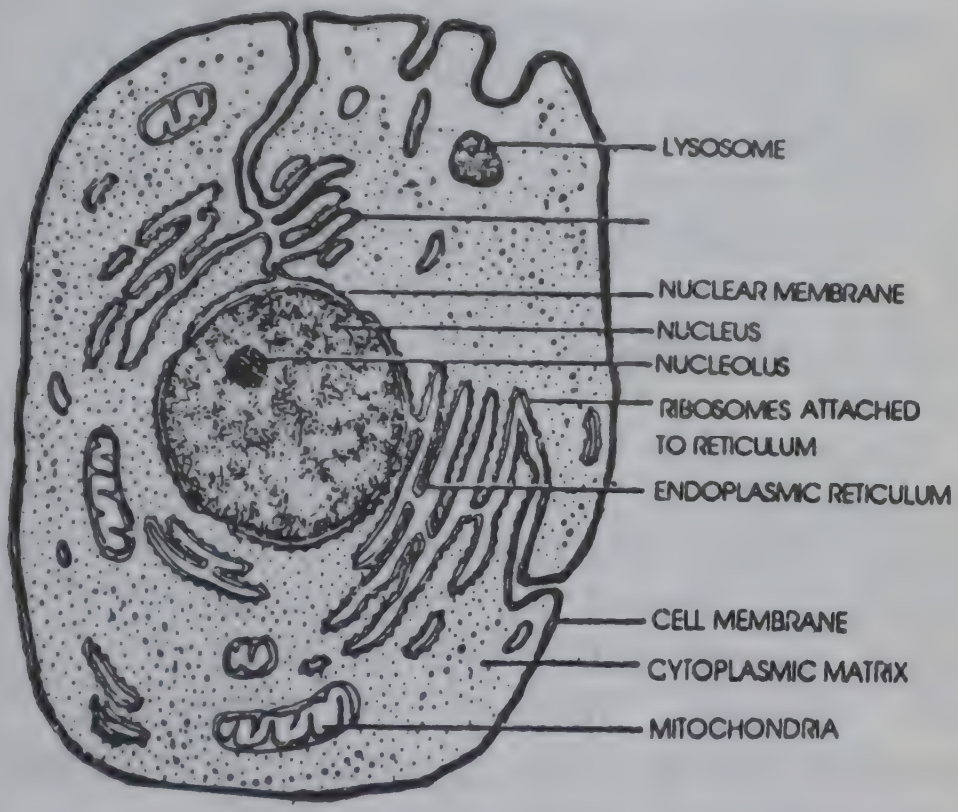


Fig. 8.4. Generalised Animal Cell

The cell is always bustling with various life activities involving biochemical reactions. Fig 8.4 shows that the cell is surrounded by cell membrane. It controls the movement of the substances in and out of the cell. It is like a sentry guarding a factory and checking people who enter and leave. Essential materials, water and food are allowed to enter into the cell. The waste materials are passed out of the cell. If the cell membrane is damaged, the cell is destroyed.

You see a dark part in the cell. It is the nucleus which can be compared to a control room in a factory. It controls all the life activities of the cell.

The nucleus is surrounded by a jelly like substance called cytoplasm. A special type of microscope called electron microscope shows many structures called 'organells' in the cytoplasm. Cytoplasm and nucleus together form protoplasm.

Materials are transported within the cells through a series of membranes called endoplasmic reticulum. It provides large area for chemical activities in the cell.

All life activities need energy. Naturally there must be a generator for supplying energy for all the life activities. The cell contains tiny 'power houses' called mitochondria. Energy is produced in these bag like structures during respiration.

The plant cells have a rigid outer wall surrounding the membrane. This cell wall is made up of a substance called cellulose. Many of the cells in leaves and other green parts of the plant contains tiny structures called 'chloroplasts'. You are already familiar with the name 'chlorophyll' - the green colouring matter. The chloroplasts contain chlorophyll. It plays a very important role in preparing food. It can be called the kitchen of the cell.

Have you ever wondered how a seed grows into a plant within a few days? Microbes like bacteria grow within few hours. A new born baby grows into a small child within a year. It almost seems to be a magical change. Growth is the result of increase in the size and number of cells in an organism. All living organisms orginate from a single cell. The fertilized egg cell divides into two daughter cells. They further divide. The mass of cells formed after continuous cell divisions differentiate into various tissues to perform different functions. Ultimately new organism is formed. Plants and animals have different types of tissues.

Activity: Grow Onion roots in a jar and ask your teacher to show a section of the root tip under the microscope. See whether you can find any dividing cells.

Plant Tissues

The plant tissues can be classified mainly into four groups. The root, stem, branches, leaves, flowers, fruits and seeds are covered by the dermal tissue. It is a protective tissue. The dermal tissue not only protects the inner tissue, it also takes up functions like controlling evaporation of water from the plant and exchange of gases like oxygen and carbon dioxide. The dermal tissue of the roots helps in the absorption of water and salts.

Activity: a) Take a radish, cut off its lower tip and dip it in red ink solution for few hours. Take it out and cut thin horizontal and vertical slices. Observe the red colour in the central part. b) Take a balsam plant with white flowers. Dip it in red ink solution. Observe the leaves and flowers.

There are special tissues for transporting water, salts and food. These are called vascular tissue.

The water, salts and other nutrients are transported from roots to the leaves by a kind of vascular tissue called Xylem. The red lines you observed in the radish, and the leaves and flowers of balsam in the above experiment are of this type of tissue. The prepared food from the leaves is transported to other parts of the plant by another type of vascular tissue called Phloem.

You are familiar with coir. It is a plant tissue providing mechanical support to the plants. Such tissues are called supporting (ground) tissue. These tissues are found in roots, stems, leaves and flowers. They contain elongated cells

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which are thick at the corners. They may also contain dead cells with thick cell walls. If they contain chloroplasts they help in the manufacture of food.

The supporting tissue, the vascular tissue and dermal tissue are often known as permanent tissues. However these tissues are basically derived from growing tissues called meristematic Tissue.

You remember observing the cells in the roots of onion. Those cells form meristematic tissue or meristem. All growing regions of the plant like root tip, stem tip, tips of branches and wherever there is active growth consist of mersitems. The meristematic tissue consists of small, cubical, thin walled cells. The cells of meristematic tissue actively divide adding new cells. In later stages these tissues are transformed into permanent tissues. Meristematic tissue is also found between the bark and the wood of trees. It leads to the growth in the diameter of the stem.

These various types of tissues are organised in such a way that the plants carry on life activities.

Animal Tissues

The animal body is also made up of various types of tissues.

The outer layer of the body is covered by a protective tissue called epithelial tissue. The outer surface of the skin and the inner surface of the mouth, food canal, stomach, intestine, lungs are made up of epithelial tissue. The epithelial tissues are of different kinds.

Observe the fig. 8.5. You will find that different epithelial tissues have cells of different shapes. The shapes depend on their location and function. The cells may be flat and tightly packed or elongated and arranged in columns. Sometimes they take up special functions like secreting digestive juices as in the case of the inner wall of the

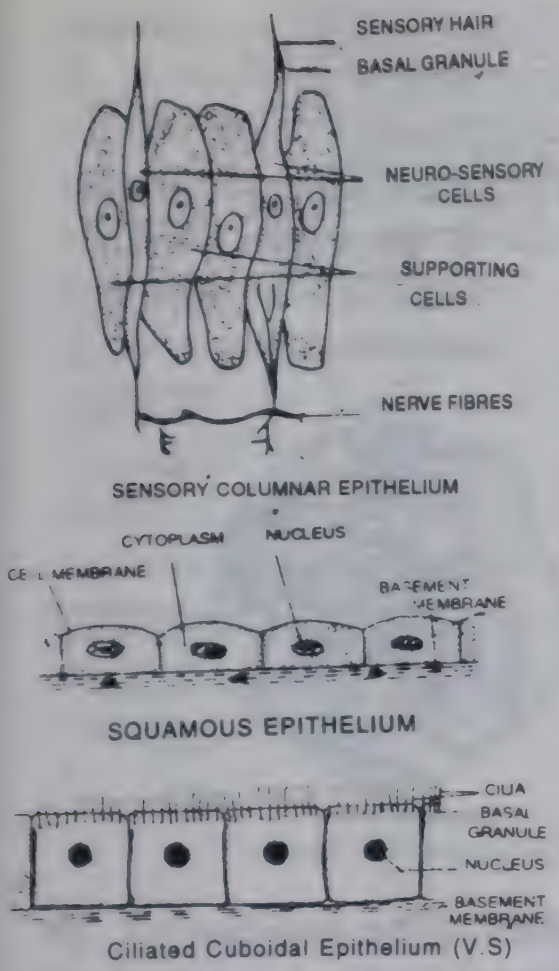


Fig. 8.5 Different types of Epithelial Tissues

stomach. Epithelial cells of skin help in removing waste substances. The epithelial tissues in small intestine are modified to absorb the digested food. Some epithelial cells have hair - like structures called cilia which help in the movement of materials.

There are tissues specialised for connecting the various tissues and organs. They are called Connective Tissue. They also help in keeping the organs in place or supporting them.

Fig 8.6 shows different types of connective tissues like tendon, ligament, cartilage, bone and blood. Tendons are fibrous and they connect muscles to the bones. The ligaments connect bones together in joints like elbows and knees. You can twist your nose and the external ear because they are made up of a connective tissue called cartilage. It is an elastic and fibrous tissue. The bone is a hard tissue made up of calicum and phosphorous compounds. The living bone cells are scattered in a substance called matrix. Blood is the fluid tissue. The cells are dispersed in a liquid called plasma.

The muscles of the body form the muscular tissue. The muscles contract and relax. They help in body movements. For example, you want to throw a cricket ball or run. The muscles of our hands and legs move according to our will.

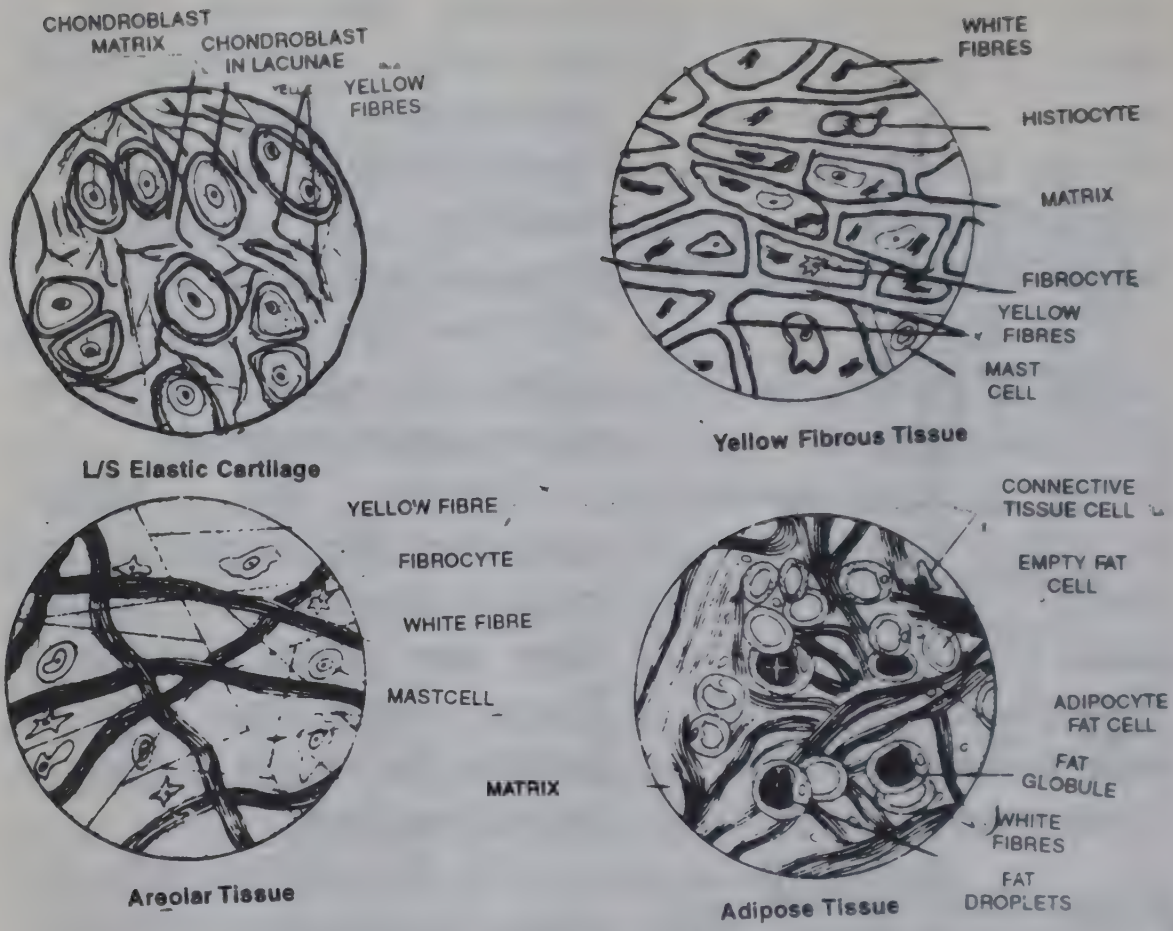


Fig. 8.6 Types of connective tissues

They are called voluntary muscles. The muscles of the organs like heart, stomach and intestine are not under our control. They are called involuntary muscles. The muscles of the heart are made to function tirelessly throughout life.

When your friend pricks your hand with a sharp pencil,

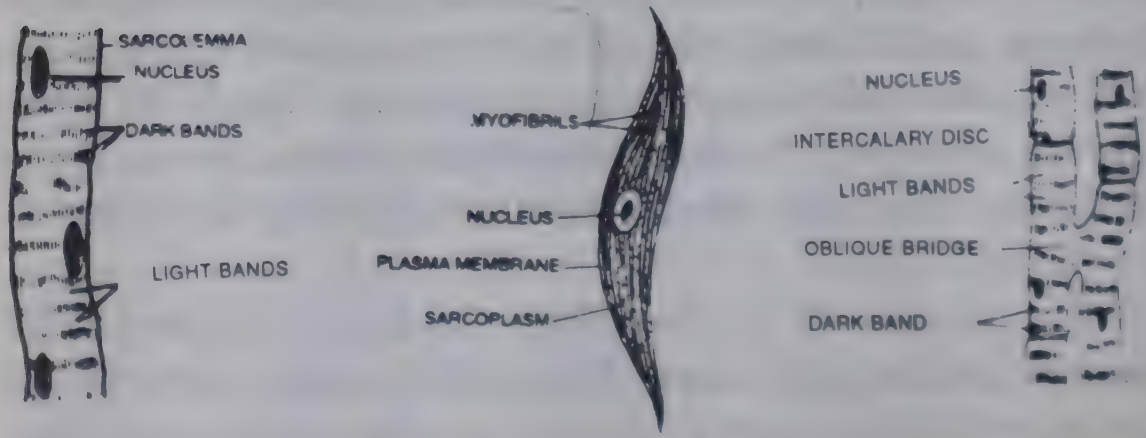


Fig. 8.7 Types of muscle cells
A-Voluntary muscle B-Involuntary Muscle C-Heart muscle

immediately you will withdraw your hand. This type of reaction is possible because of nerve tissue. See fig. 8.8. A nerve cell has a long extention called axon and small brush like structures called dendrites. The nerve cells are arranged from end to end forming nerve fibres and nerves. They carry impulses from all parts of the body to the brain and spinal cord. The brain and the spinal cord are also made up of nerve tissue. We have the highest developed nerve tissue that is the 'brain'. The nerve tissue helps the body to control and co-ordinate the various activities.

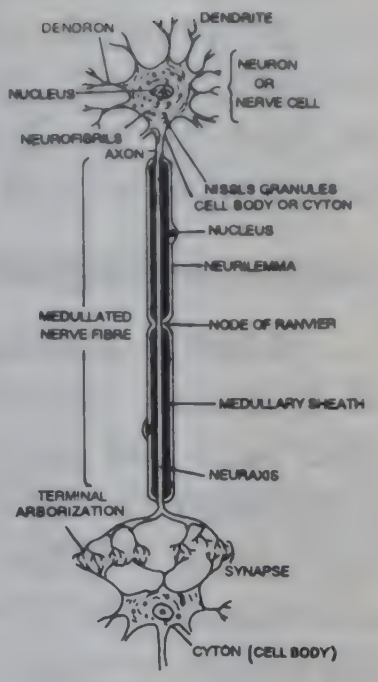


Fig 8.8 A nerve cell

Exercises

1. Enumerate the differences between a plant cell and animal cell.
2. List different types of tissues found in plants and animals.
3. What are the different levels of organisation found in organisms?

UNIT - 9

WATER

Water in an important substance essential for life. Water covers some three fourths of the earth's surface.

Water has some unusual properties which are of some relevance to life. Unfortunately water can be easily polluted and made harmful to our health. The sea water which forms

a major share is unsuited for drinking or irrigation due to the presence of salts like sodium chloride, magnesium chloride, sodium carbonate and magnesium carbonate. So we have to pay attention for prevention of pollution as quality of water is of great importance to human life.

Volumetric composition of water:

Water is a compound of hydrogen and oxygen. Hydrogen and oxygen are in the ratio 2 : 1 by volume in water. This can conveniently be shown by electrolysis of water.

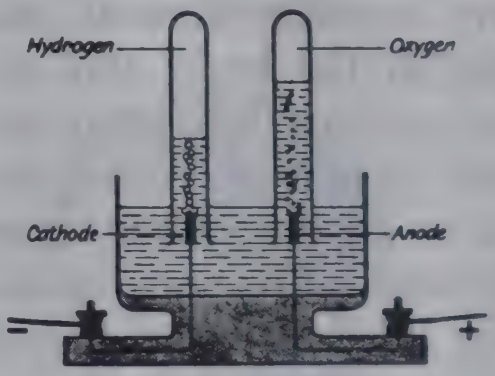


Fig 9-1

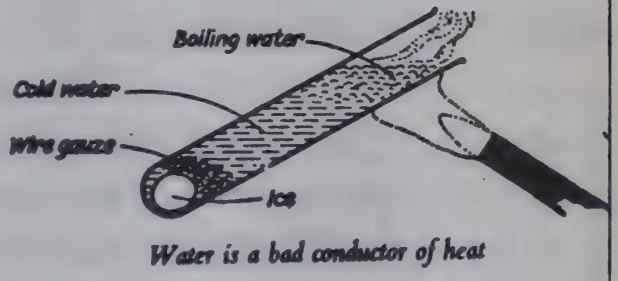
Activity: Voltameter : (fig as shown) Pour some water into a voltameter. Pure water does not conduct electricity. Add a little dilute sulphuric acid to make it a conductor. There are two platinum electrodes at the bottom of the voltameter. Fill two test tubes of same size completely with water. and invert them over the electrodes. Connect the electrodes to two terminals of a battery. Now electricity flows through water. Tiny gas bubbles start collecting in both the test tubes. After sometime, compare the volumes of gases collected in the two test tubes. The ratio of gases will be 2 : 1.
Continue to pass electricity. Remove the first test tube completely filled with gas and cork it. Bring a burning paper near the mouth of the test tube and remove cork. The gas burns with 'POP' sound. Hence this gas is hydrogen.

Remove the other test tube when it is also completely filled with gas. Introduce a glowing splinter into it. The splinter catches fire and burns brightly. Hence this gas is oxygen. This experiment shows that hydrogen and oxygen are present in the ratio 2 : 1 by volume in water. In place of platinum electrodes, cheaper stainless steel rods can be used in water voltameter.

Water is a bad conductor of heat :

Heat flows in water or any other liquid by convection currents. That is why water acts as a bad conductor of heat. This will be clear from the activity given here under.

Activity: Wrap ice in a wire gauze and drop it into a test tube containing water. The gauze keeps ice at the bottom. Heat the water near its surface (as shown in figure) until it begins to boil. The ice will not melt soon. Why?



Water is a bad conductor of heat

Fig 9.2

Ice floats on water:

Water freezes into ice at 0^{o}C. When water freezes into ice, there is a slight expansion in volume. Hence the density of ice is less than that of water. So ice floats on water.

Activity: Drop ice cubes into a beaker containing water and observe that ice floats on water.

The expansion of water in volume during bitter cold cause the pipes to burst. But on the other hand this peculiarity of water is extremely fortunate for mankind and for all life since it prevents freezing of a large part of the earth's water which has millions and millions of creatures. Think what would happen if ice were heavier than water, lakes and seas would freeze from the bottom when the temperature went below $0^{o}C$; they would become solid blocks of ice killing all the aquatic animals. There would have been less evaporation of water and therefore much less rain.

Water reacts with some metals:

The metals - like sodium, potassium and calcium react vigorously with water. Hydrogen gas is liberated and respective metal hydroxides are formed.

These metals are readily attacked by moist air. Hence sodium is preserved under kerosene.

Activity: Cut a small piece of sodium with a knife. Press on a filter paper to remove the kerosene oil. Drop it into water in a trough. The metal reacts with water and moves around the water surface with a hissing noise. Hydrogen gas is liberated and sodium hydroxide is formed.

If you, use slightly warm water, a flame is seen due to burning of hydrogen.

Dip a red litmus paper into the water red litmus paper turns blue. This shows the presence of sodium hydroxide, an alkali in the water.

(Note: Sodium is very reactive metal; care must be taken to handle it.)

Magnesium is less reactive. It does not react with cold

water. It reacts with boiling water only. Hydrogen gas is liberated and magnesium oxide is formed.

In moist air, iron slowly rusts i.e., it reacts with both oxygen and water. Brown solid of hydrated ferric oxide is formed. This is called rust. Iron is used in the construction of buildings, factories, bridges, ships and vehicles. Rusting of iron causes serious problem. It leads to weakening and collapse of the structure. Prevention of rusting of iron is hence very important. It is usually done by coating the surface with paint or making alloys with metals like zinc, tin, chromium which are not attacked by moist air.

Water is a good solvent:

Water has the ability to dissolve many substances. Hence it is called the universal solvent. It dissolves salts and minerals. Rain water is pure water. When it reaches the ground it comes into contact with several salts and minerals there and dissolves some of them. In fact water has a taste due to the presence of dissolved salts.

Activity: Collect a sample of water from any source. Filter it through a filter paper. Heat the filtered water in a dish on a sand bath. Water gets evaporated but not the salts when all the water has been evaporated observe the residue.

This shows that natural water contains dissolved salts and minerals.

Water dissolves a small amount of air in it. Plants and animals that live in water make use of the dissolved oxygen for their respiration.

Activity: Observe the fish in an aquarium or a pond. They take water into mouth and expel it through gills. Hence you see the movements of their mouth and gills. Gills are special organs in fish. they help fish in absorbing dissolved oxygen in water. Thus fish can survive only through dissolved oxygen in water.

Salinity of water :

Saturated solution: A solution that contains maximum amount of the dissolved substance at a given temperature is called saturated solution of the substance.

Activity : Take about 25 cm^3 of water in a beaker. Add a small amount of sugar into it. Stir it with a glass rod. Sugar dissolves. Add some more sugar and stir. This may also dissolve. Continue to add sugar a little at a time, with stirring. At some stage you will see that some sugar remains undissolved even after prolonged stirring. Now decant the clean solution into another beaker. This is a saturated solution of sugar at room temperature. It contains maximum amount of sugar in it.

In many places, rain water dissolves considerable amounts of salts when it passes through layers of soil. Hence the water tastes salty. This water is called saline water (saline means salty). Salinity of water is thus due to the dissolution of too much of salts and minerals in water. Water salinity is a serious problem in Gujarat and Rajasthan.

Sea water is very saline:

River water brings dissolved salts and minerals into sea. Sea water is continuously evaporated by the sun. This evaporated water forms clouds and brings rain. The rain

falling on land dissolves more salts and minerals there and brings them into sea through rivers. Thus sea continues to get salts and minerals.

Though sea water receives fresh water (rain water, river water) it turns saline due to continuous evaporation by sun. Sea water is very saline because of high concentration of salts and minerals. One litre of sea water contains about 35g of salts. The water we drink contains not more than 0.1 to 0.2% of salts per litre.

Saline water is not suitable for industrial uses also. It corrodes metals. So there is a need to remove salts from saline water.

Distillation of Water:

In places where only saline water is available pure water is obtained from it by distillation. Water is boiled and the steam produced is condensed. Salts and minerals being non volatile, are left in the boiler. The water thus obtained is free from dissolved salts. It is called distilled water.

Distilled water is completely free from dissolved salts. It is not good for drinking. Because it will dissolve vital chemicals from our bodies. Hence distilled water is mixed with small amounts of salt water and used for drinking.

Hard and Soft water:

Soft water forms lather readily with soap. Water which does not give lather readily with soap is called hard water.

Rain water is very soft as it gives plenty of lather with soap.

Hardness of water is due to the presence of soluble calcium and magnesium salts in water.

There are two kinds of hard water (1) temporary hard water which contains bicarbonate of calcium and magnesium. (2) permanent hard water which contains

chlorides and sulphates of calcium and magnesium. Hard water is not fit for domestic and industrial uses. Hard water does not lather readily with soap. Instead it produces a white precipitate. This is because calcium and magnesium salts react with soap and form insoluble substances. This causes wastage of soap. Hence washing with hard water is uneconomical.

When hard water is used in steam boilers calcium and magnesium salts in it deposit as a hard crust on the walls of the boiler. This crust is a bad conductor of heat. It increases fuel consumption. Besides, the crust may constrict the passage in boiler pipes which may lead to the risk of explosion of boiler. This shows that there is a need to remove calcium and magnesium salts in hard water before it is used in industries.

Removal of hardness of water is called softening. When dissolved calcium and magnesium salts are removed from hard water, it becomes soft. There are many methods of softening hard water.

Permutit Process:

Permutit is sodium aluminium silicate (Zeolite mineral). In this method, hard water is passed through a bed of permutit. Calcium and Magnesium salts react with Permutit and form insoluble calcium and magnesium permutit. The issuing water is hence soft. When all the permutit is converted into calcium and magnesium permutit, it becomes ineffective. It is regenerated by soaking this in concentrated solution of brine (sodium chloride). It is then rinsed with some soft water and used again in softening hard water. Some soap powders contain Zeolite for this purpose.

Calcium chloride + Sodium permutit

---------- > Calcium permutit + Sodium chloride

Hard water can also be softened by the addition of a compound called calgon (sodium hexameta phosphate). Detergents contain calgon for this purpose.

Ion-exchange method:

Hard water is passed through a mixed bed of ion exchange resin. Unlike other methods all salts (all ions) are removed completely from water. Hence this water is called deionised water. Ion exchange method is employed in industries to get deionised water.

Fresh water is scarce in Arab countries. Hence distilled water is produced on large scale by the distillation of hard water. The method is expensive.

Water Pollution

The presence of undesirable matter in water makes it polluted.

Man needs clean and fresh water. Water is used for drinking, cooking, bathing, washing, irrigation and industrial uses.

Inland water is often polluted by the presence of harmful chemical substances and micro-organisms.

Polluted water is unfit for drinking, bathing and other domestic uses. It is also harmful for plants and animals. Hence water pollution is a serious problem.

Let us consider the major causes, harmful effects and prevention of water pollution.

In many rural parts in our country people defecate in open fields. The rain washes away human excreta and animal dung into nearby water sources. In many cities sewage, is dumped into nearby rivers. Sewage also contains human excreta and other organic waste matter, like paper, soap, detergents dirt etc., The human and animal excreta contain several harmful microorganisms (germs and

parasites). These causes several water borne diseases such as typhoid, cholera, jaundice, diarrhea, dysentery, polio. Hence these diseases spread rapidly to the whole community by drinking polluted water. These diseases are called epidemic diseases. Besides, worms also enter into our bodies as tiny eggs and grow in the intestine. Tape worms, hook worms and round worms are some of the examples. These worms consume food we eat and cause disorders. Hence these are called parasites.

In order to prevent water pollution, human and animal excreta should be prevented from mixing in water sources. This can be achieved by building pit Latrines and treating sewage properly before putting it in rivers. The animal dung and other debris must not be heaped near water sources. Human and animal dead bodies must not be thrown into rivers.

Industrial wastes (effluents) from chemical industries often contain toxic chemical substances. Compounds of heavy metals such as lead, mercury, cadmium and arsenic are highly toxic. They are in chemical, textile and leather industries. Hence these toxic chemicals are present in the effluents from these industries. Dye stuff and paint industries, pulp and paper industries pesticides industries throw out harmful organic compounds as wastes. Sugar, meat and food processing industries also give rise to acidic, alkaline greasy waste.

Many of these industrial wastes are discharged into nearby rivers without treatment. The river water thus becomes poisonous for the fish and river plants. The toxic chemicals that enter the river are not cleared (decomposed) easily by natural process. Hence these chemicals get accumulated and pollute the water. As a result several diseases are caused to the people who use the river water.

Another source of pollution is the run off from

agricultural lands. Pesticides are extensively used in agriculture. These are washed off by rain water into water sources. These are also toxic chemicals. They get accumulated in the water and water is thus polluted. Hence indiscriminate use of pesticides must be avoided.

In order to control water pollution, the industrial wastes have to be treated properly before they are released into rivers, lakes and seas i.e., the harmful chemical substances in them have to be converted into harmless compounds. This must be done at source by the industries themselves.

The next step is the purification of rivers, streams, ponds and lakes. This is to be done both by the industries and the government. One such example is the Ganga purification Project. Ganga is one of the most polluted rivers of the world.

The Indian Government has taken up the task of purifying the river Ganges. The sewage in all towns and cities on the banks of the river is treated before it is released into the Ganges. This treatment makes the sewage water harmless. Similarly the industrial wastes are initially treated at the factories. The treated water is then let into the river. Many trees have been planted along the banks of the river. These not only enhance natural beauty but also help in clearing up the environment. Certain aquatic animals like tortoise, fish are also cultured. These also help in cleaning up the polluted water. These aquatic animals are called natural scavengers.

Exercise

1. Write a neat diagram of a water voltameter and label its parts.
2. How do you show that water is a bad conductor of heat?
3. What happens if ice would be heavier than water?

4. Sodium metal is preserved under kerosene. Why?
5. Why do you call water "a universal solvent"?
6. What is the reason for the salinity of sea water?
7. What is Hard water?
8. Mention the methods of softening hard water.
9. Describe the permutit process of softening hard water.
10. How can you avoid water pollution?

UNIT 10

AIR

The atmosphere is a mixture of many gases which surrounds the earth's crust. It is about 200 Km thick. It contains mainly nitrogen and oxygen. It also contains small amounts of other gases such as argon, helium and neon. Also present are some gases like Carbon dioxide produced by combustion of fuels including sulphur dioxide, hydrogen sulphide and carbon monoxide, dust, bacteria and other matter. Ordinary air always contains water vapour usually between 1 to 4 percent.

Composition of air	*Percentage by volume*
Nitrogen	78
Oxygen	21
Arbon and others	0.97
Carbon dioxide	0.03

Oxygen is the most important gas because it is vital to all living things. Nitrogen is the major constituent of air. It is not a reactive gas like oxygen.

Air is a mixture

The constituents of air - nitrogen, oxygen, carbon dioxide etc can be easily separated. Hence air is a mixture.

Air also contains water vapour. You have studied in the

earlier classes that water is heated up by the sun and changes to vapour. The tiny particles of water jump into the air and rises up in the air. Plants also give up excess of water in the form of vapour. The amount of water vapour in the air varies from place to place. The content of water vapour in air is called humidity.

Burning of fuels like firewood, oils, gas and petroleum adds smoke into the air. In addition the industries release a lot of smoke into the atmosphere. Hence the percentage of carbon dioxide varies like the water vapour. The factories also release harmful gases such as sulphur dioxide, hydrogen sulphide etc. The decomposition of dead organism also adds on hydrogen sulphide, ammonia etc into the atmosphere.

Constituents of air and their uses.

Nitrogen forms the major constituent of air with 78% and oxygen 21% by volume. Carbon dioxide is about 0.03%, argon and other inert gases are about 0.97%

Nitrogen

Nitrogen is not a reactive gas under ordinary conditions. Nitrogen dilutes the oxygen in the atmosphere and therefore reduces the rates of respiration, combustion, rusting and corrosion of metals and other processes that use up oxygen. Nitrogen compounds are essential for the growth of plants. Nitrogen compounds such as ammonium sulphate, Ammonium nitrate, potassium nitrate and urea are used as fertilizers. Some compounds are also used in explosives, dyes and drugs.

Nitrogen in the atmosphere reacts with oxygen to form oxides of nitrogen under a high temperature produced by lightning in the cloudy sky. These oxides dissolve in rain water to form their respective acids which in turn react with salts in the soil to form nitrates. Plants make proteins from

nitrates. Proteins are the building materials of all living things. Animals get their protein from the plants. Some organisms in the soil use the nitrates in the soil for their growth.

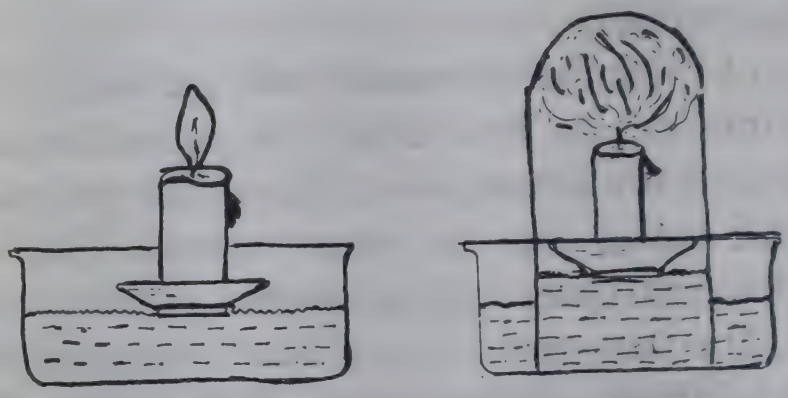


Fig. 10.1 Oxygen necessary for burning

Activity - 1 : Fig 10.1 : Place a plastic plate in a trough containing water. Fix a candle on the plastic plate as shown in the figure. Light the candle and invert a glass jar over it. Graduate the jar by dividing its volume into five equal parts. The candle burns for sometime making use of the oxygen of the air inside the jar. Observe the level of water when the candle is put out.

The above experiment shows that air contains one fifth of oxygen and four fifths of nitrogen.

Oxygen

You have learnt that air contains about one fifth of oxygen. Therefore one fifth of the air is active (oxygen) and four fifths is inactive air (Nitrogen and other gases). Oxygen helps combustion. Combustion in air is a chemical change in which substances combine with oxygen to form oxides and to produce heat. Burning of candle, kerosene, petrol etc. are examples of combustion. Explosion of crackers is also a combustion which is *spontaneous*. Respiration and rusting are examples of slow combustion.

Oxygen is present in many substances such as potassium chlorate, mercuric oxide, potassium permanganate, red lead oxide, hydrogen peroxide etc.,

Oxygen can be prepared in the Laboratory by heating a mixture of potassium chlorate and manganese dioxide. The mixture is taken in a hard glass test tube fitted with a delivery tube. The other end of the delivery tube is placed in a trough containing water under a beehive shelf. The mixture is strongly heated. Oxygen is liberated which is collected by the downward displacement of water.

Oxygen from air

Oxygen and nitrogen are required in large quantities by industries. They are obtained from air. Air, free from dust is compressed and cooled several times, when it becomes a liquid. Liquid air is a mixture of oxygen and nitrogen which are separated when heated.

Balance in nature

Activity - 2: : Place a few water plants underneath a funnel in a beaker containing water. Insert a glass test tube filled with water over the stem of the funnel. Keep the apparatus in sunlight for a few hours. A gas collects in the test tube displacing the water, Test the gas by introducing a red hot splinter. What do you observe?

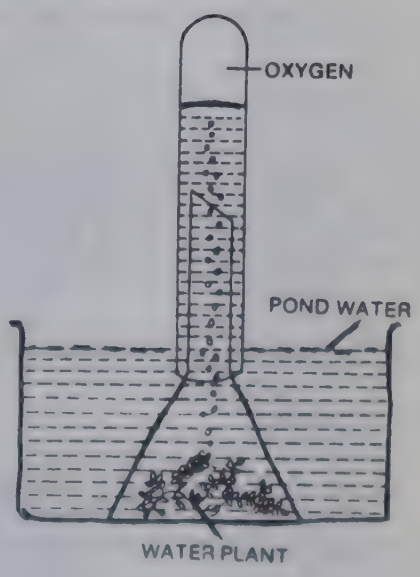


Fig 10.2

During respiration, plants and animals take in oxygen of the air and breathe out carbon dioxide. If this goes on for ever, all the oxygen present in the air is changed to carbon dioxide, but this is not so. Plants make use of carbon dioxide for food manufacture and give away oxygen during the day. On account of this, the percentage of oxygen in the air is kept almost constant.

Carbon dioxide

Though the percentage of carbon dioxide in air is very little (about 0.03%), its percentage increases due to pollution.

Carbon dioxide is used in fire extinguisher and aerated drinks. Dry ice or carbon dioxide snow is much colder than ice. It is used for cooling ice cream, packing fish and to deep freeze some foods.

Activity - 3 : Introduce a burning candle into a gas jar containing carbon dioxide. What do you observe.

Activity - 4 : Take about half a test tube filled with clear lime water. Pass carbon dioxide from a glass tube through it for sometime. What do you observe?

Inert gases

For many years, argon, helium, neon were called 'rare' gases and then they were called 'inert' gases because it was believed that they did not form compounds. Recently some compounds have been prepared and so these gases have been renamed noble gases. Helium, argon, neon, krypton

and Xenon exist in the atmosphere.

Argon and neon are used for filling electric bulbs and sign tubes. Helium is used to obtain low temperature.

Air Pollution

You have seen the motor cars, scooters and trains releasing a large quantity of smoke. The smoke mixes with the air. Thus the air becomes polluted. The polluted air is harmful for health. The factories also give out the smoke, chemicals and other poisonous gases. These substances are called pollutants. Burning of fuels at home, and the forest fire also make the air pollute. The pollutants are harmful to both plants and animals. They cause various health disorders and diseases. Polluted air **causes** respiratory disorders such as bronchitis and lung cancer. The increased number of automobiles have become the largest source of air pollution in the cities. Wind also **pollutes** the air by adding dust, bacteria and other particles into the air.

If the factories where fuels are burnt have long chimneys, the smoke escapes high above and prevent some pollution. The houses should also be provided with chimneys for the smoke to escape high enough in the air. The vehicles should also control the emission of the gases. The government has taken several steps to control the air pollution. One of the steps to control the air pollution due to automobiles is the emission test. The factories should remove the poisonous gases from the smoke before they are let into the air.

Exercise

1. What are the constituents of air?
2. How do you say that air is a mixture?
3. What is combustion? Give examples.
4. Mention four uses of nitrogen.

5. Describe how would you show that air contains one fifth of active part
6. How do you prepare oxygen in the Laboratory?
7. Mention three uses of oxygen.
8. How do you show that plants give out oxygen during dav.?
9. How is air polluted?
10. Mention any two steps to prevent air pollution.

Fill in the blanks with correct answers.

1. Oxygen is obtained on a large scale from .....
2. Air consists of ..... and ..... part.
3. ..... and ..... are inert gases.
4. Neon is used to fill .....
5. ..... are the building materials for all living things.

UNIT - 11

LIFE PROCESSES

All living organisms perform certain basic functions like nutrition, respiration, excretion, response to stimuli, growth, reproduction and so on.

Energy is needed for all the life processes.

A car needs energy for its movement. Petrol provides energy. In the same way organisms need energy to carry out their life processes.

Energy is obtained from the food.

Food acts as fuel which produces energy needed to carry out different activities of the body.

Observe : Our body weight increases as we grow, It shows that some part of our food must be used to build up body material.

Food is important in the life of an organism. Therefore let us learn how different organisms get their food.

Green plants prepare their own food.

Let us first try to know how plants get their food. You have seen plants around us. You know that the green leaves of the plants contain chlorophyll and by the help of chlorophyll plants can prepare their food.

Plants require carbon dioxide and water to prepare carbohydrates (food) in presence of sunlight. This process is called photosynthesis.

What happens during photosynthesis? Here carbon dioxide and water react to produce carbohydrates and oxygen. This oxygen is released to the atmosphere. Chlorophyll present in the leaves trap light energy from the sun and convert it into chemical energy to produce carbohydrates. The carbohydrate is later converted into starch and stored in the plants.

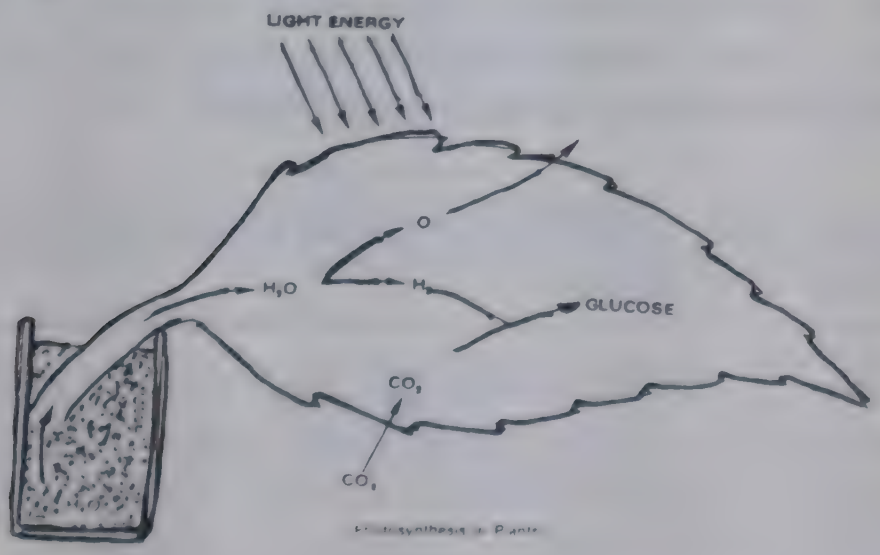


Fig 11.1 Diagram showing preparation of food by green plants.

Photosynthesis is important for the sustenance of life of all living forms.

Now you know that food is prepared by the plants, during photosynthesis for themselves. Then it forms a source of food for the other living organisms which depend upon plants for food. Ex : Animals. You also know that living organisms use oxygen for respiration. When the oxygen is used, the percentage of oxygen in the atmosphere has to be decreased. But the oxygen released during photosynthesis replenishes oxygen to the atmosphere and thereby the oxygen content is maintained.

Some organisms get their food from dead and decaying organic matter or from other living organisms.

You have learnt that during photosynthesis, the solar energy is utilised by the green plants to prepare food. Hence we call green plants as producers or autotrophs (self feeders). Some organisms which do not contain chlorophyll, cannot prepare their own food. They should depend either on dead and decaying organisms or other living organisms for their food.

You might have seen the decaying dead plants and animals. This is brought about by a number of fungi and bacteria. They absorb soluble minerals for nutrition by breaking down these dead organic matter.

Activity:- Keep some moist coconut or bread for a few days. Observe what happens.

Animals including man get food from plants; you can get vegetable, cereals, pulses from plants. Certain animals like rabbit, eat plants directly as food. Some other animals like tigers eat other animals and get their food.

Mode of procuring food varies in different animals. Butterfly sucks the nectar with the help of feeding tube.

Frog has sticky biforked tongue to catch the insect.

Wild animals like lion, tiger, have sharp teeth and claws to tear the prey.

We take food by the help of our hands.

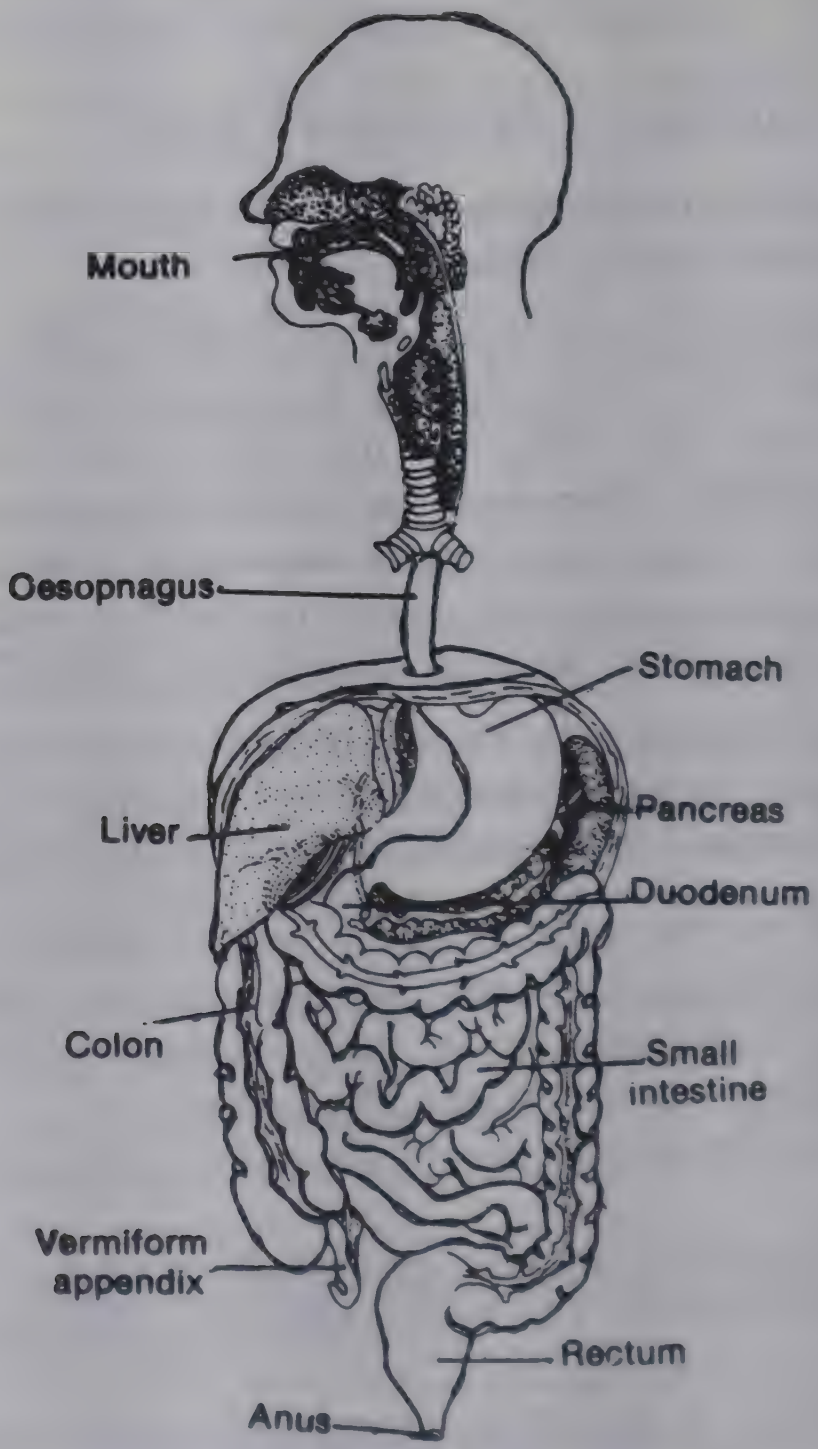
Animal nutrition comprises ingestion, digestion, absorption, assimilation and egestion.

The taking of food inside the body is called *ingestion.* The food taken is the complex molecules of carbohydrates, proteins and fats. These are too large to pass through the cell membrane. Therefore the large food molecule should be broken down into simpler molecules. This process is called *digestion.* Animals digest the food by both physical (like chewing) and chemical methods (use of enzymes) with the help of many organs. Then the food which has been reduced to simple forms is absorbed by the small intestine. This is called *absorption.* The absorbed substances are used by the cells to build special types of proteins (characteristic of the tissues), storage products. This process is called *assimilation.* Lastly the undigested matter passes out of the body by the process of *egestion.*

There are specific organs for carrying out nutrition in animals.

In Unicellular animals like amoeba there are no special organs of digestion. The food is digested within the cell by the help of certain enzymes.

In simple multicellular animals like hydra the food is taken into the cavity. The cells lining the cavity secrete chemicals to digest the food. The digestion is partly outside the cells. The cells take partly digested food inside and digest them further. Then the digested food is absorbed by the body cells. Waste products are thrown out through the



11.2 Digestive system of the human being.

mouth.

In higher animals like earthworm, fish, frog and man there are specific digestive organs.

It is interesting to know that digestion in our body starts in the mouth itself. When we take food, our teeth help in cutting and chewing it. The tongue helps the food to mix with saliva produced by salivary glands present in the mouth. An enzyme called amylase present in salivary juice helps to digest the carbohydrates into sugar.

From the mouth food enters into the oesophagus (food pipe). The food passes by the contraction and relaxation of the muscles of the food pipe. This is called peristaltic movement, which makes food enter into the stomach.

Digestion continues in the stomach where proteins are made simpler by the action of enzymes present in the gastric juice. Further the digestion is continued in the small intestine by the help of other glands such as liver which produces bile juice and pancreas, which produces pancreatic juice. The digestion of carbohydrates, proteins and fats is completed in the small intestine with help of enzymes present in intestinal juice. The digested food is absorbed in the small intestine which has finger like projections called villi. The absorbed food is carried by the blood to different parts of the body. The undigested food called faeces is passed out of the body through anus.

The process of digestion is similar in vertebrates as well as invertebrates because the food of all organisms are chemically same. All organisms have enzymes for digesting carbohydrates, proteins and fats. Thus glucose, amino acids and fatty acids are the end products of digestion whether in an amoeba, a cockroach, a cat or a man.

Energy required for life is derived through respiration. All organisms take food in order to get energy and also for the growth of the body. How do organisms get this energy by

taking food?

Living organisms take in oxygen and give out carbon dioxide. The food taken into the body is digested and the digested molecules are burnt in the cells using oxygen with the release of energy, producing carbon dioxide. This energy is stored in the cells in some special molecules.

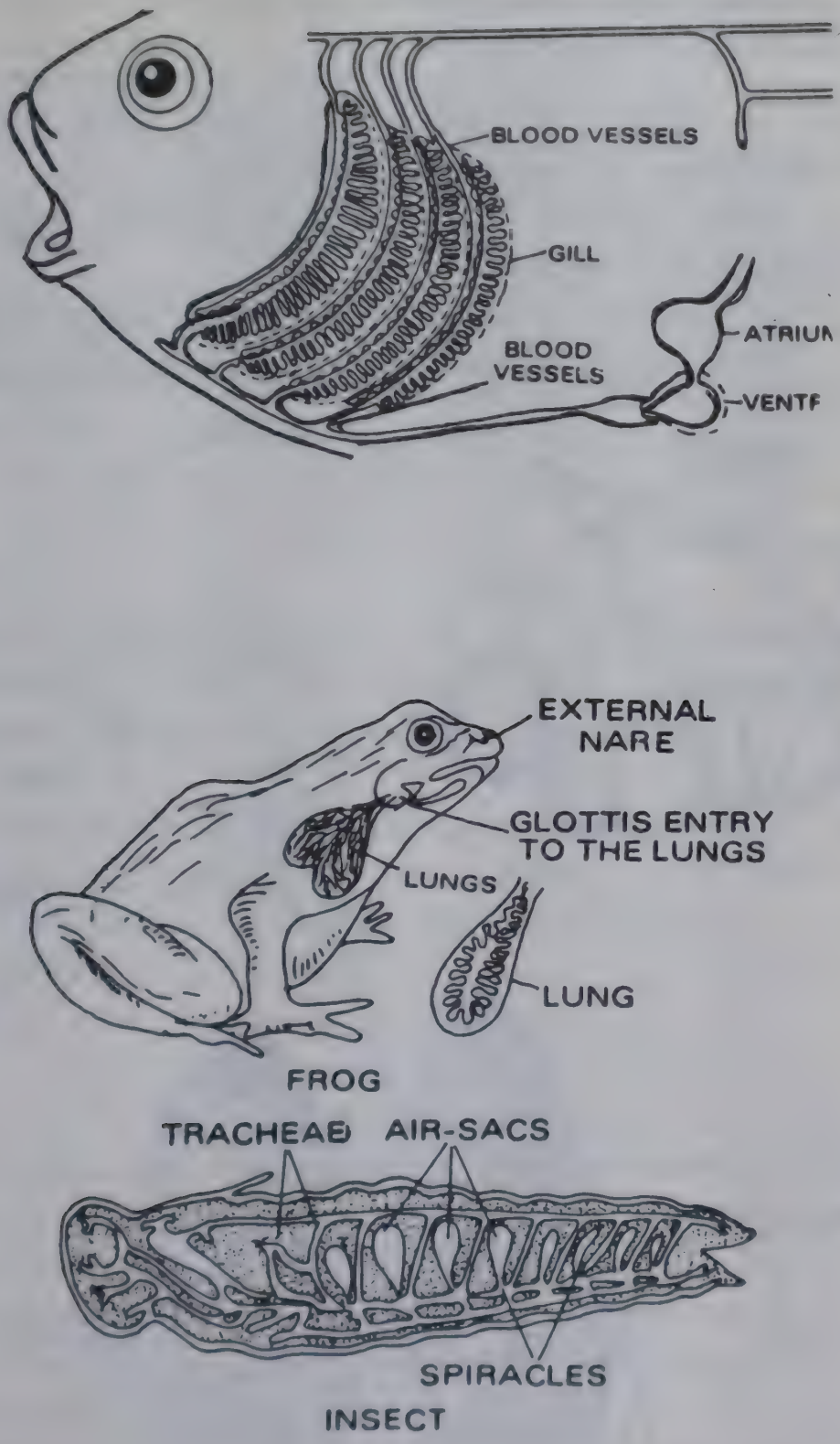
Food + Oxygen ---------- > Carbon dioxide + Water + energy.

The process of taking oxygen into the living body, using it for energy release and eliminating waste products like carbon dioxide is known as respiration. Respiration is a cellular process common to all organisms.

The process of respiration involves gaseous exchange between the organism and environment. The process of respiration involves two parts. In the first part, we take air containing oxygen from the atmosphere into the body and drive out air containing carbon dioxide. This is called breathing. Secondly this oxygen is used in the cells to burn food and to release energy.

There are different breathing organs in different animals. Simple organisms like amoeba and hydra have no special respiratory organs. As they are in direct contact with water, oxygen diffuses into the cell membrane from the surrounding water and carbon-dioxide diffuses out.

But in higher animals like earthworm and leech there are no respiratory organs. The moist skin helps in respiration by simple diffusion. In case of insects, there are hundreds of breathing tubes (trachea) through which oxygen passes to all parts of the body. Aquatic animals like fish have special respiratory organ called gills through which it takes dissolved oxygen. As water flows over the gills, oxygen is taken up by the blood and carbon dioxide diffuses out.



Breathing Organs in Animals

Fig 11.3 Gas exchange in some animals.

Know this:- A land animal cannot live in water why? The respiratory organs in a land animal cannot take dissolved oxygen as in case of gills in a fish.

In case of terrestrial vertebrates, they have more elaborate mechanism for respiration, the lungs.

Human beings perform the respiration with the help of combination of several organs.

We take air containing oxygen through our nose which passes through the throat to the larynx and on to the trachea

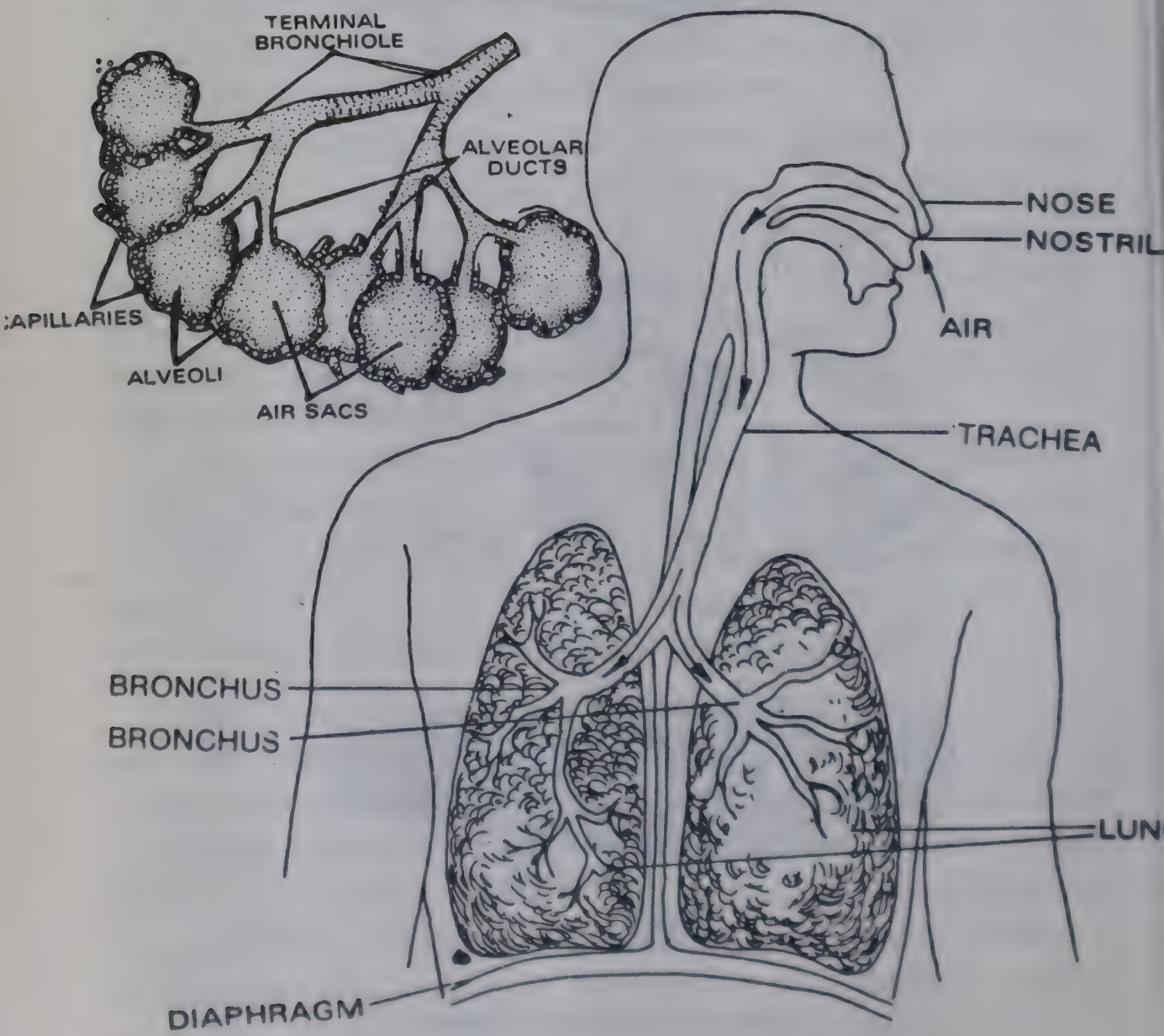


Fig 11.4 Gas exchange system in man

or the wind pipe. Trachea divides into two branches which enter the left and right lungs. In the lungs air passes through many small branches and reaches thin walled cavities called air sacs or alveoli.

The walls of aleveoli are surrounded by the blood capillaries. Oxygen of the air diffuses into the blood. Carbon dioxide diffuses out from the blood to the air sacs.

Blood in the capillaries carries oxygen to the cells of the different parts of the body. Blood contains a type of cells called RBC. They contain a red pigment called haemoglobin which carries oxygen in them. Oxygen diffuses to the cells and the blood collects carbon dioxide and water from the cells which are carried to the lungs to breathe out. All these organs complete the gas exchange in our respiration.

Activity:- 1. Count how many times you breathe (a) in normal times (b) at rest (c) after doing exercise.

We breathe 17 times per minute. It is still less when we are at rest. But breathing goes up with exercise, why?

Plants breathe through stomata and lenticells.

Plants respire at much lower rates than in animals. Gas exchange in higher plants occur at three sites.

a) Stomata in leaves. b) Lenticells in stems.

c) Surfaces of the living cells surrounding the roots.

During respiration energy in the form of heat is released slowly by breaking down sugar (glucose) the end product in the process of digestion. The byproducts formed are carbondioxide and water vapour. They are released in the form of gas to the blood and then to the lungs from where they are breathed out.

Most of the living organisms use oxygen and release carbon dioxide during respiration. The respiration, where in

oxygen is used is called *aerobic respiration.* Aerobic respiration occurs in most of the plants and animals.

There are organisms which can carry out respiration without oxygen, like yeast, bacteria and some other fungi. In this process the energy is liberated by breaking the sugar (glucose) incompletely to produce alcohol, CO_2 and energy. *This is called anaerobic respiration or fermentation.*

Transport of Materials inside the body requires liquid media and vessels.

To carry out different activities of the body organisms need nutrients and oxygen. The nutrients produced in one region of the body should reach the other parts of the body. Hence transportation of materials in the whole body is an essential process.

In simple organisms like amoeba, hydra, the nutrients enter the body through a simple process of diffusion and circulate in the body by the flow of cytoplasm. In the more highly organised form, the body size and the cell number increases. Therefore the process of diffusion of substances from the exposed parts to the inner living tissues is not adequate for the transport of materials. Therefore in complex organisms, to transport the essential materials to the cells, a liquid medium and definite vessels for its flow are necessary.

Higher plants have a system of vessels to carry water and food materials.

In plants, the transport of water, mineral salts and food materials take place both upwards and downwards continuously. To carry out their function, the plants have conducting tubes called xylem and phloem.

You know that water containing mineral salts from the soil is drawn by the root hairs., The water rises up the stem through xylem vessels and reach the leaves.

Activity: Carefully pull out a young balsam plant with white flowers. Wash its roots with water. Take some water in the beaker and add few drops of red ink to it. Keep the plant in the beaker so that roots should be in the coloured water. After few hours the stem, leaves, flowers become red. This shows that water absorbed by the root goes to the leaves through the stem.

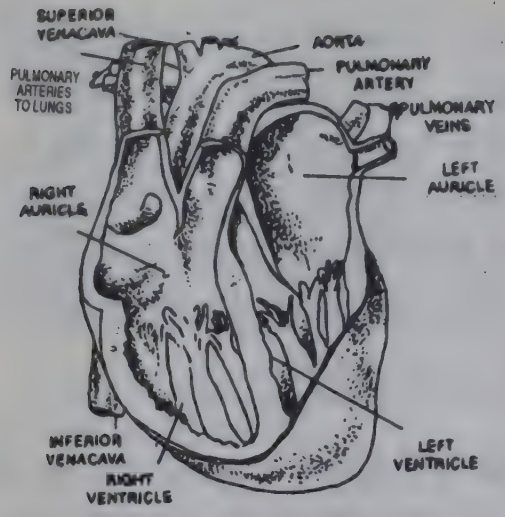
The phloem cells carry prepared food materials in the soluble form from the leaves to the other parts of the plant including roots. This may be observed in carrot, beetroot where food manufactured in the leaves is stored in the roots.

Most animals including man have a system of vessels and heart for circulating the blood. The small multicellular animals like hydra can receive the nutrients by the process of diffusion.

In higher animals blood circulation is carried out by well developed transport system which consists of heart, arteries, veins, capillaries and blood. Here heart acts as a pumping organ, arteries, veins and capillaries are pipes of different sizes and types.

Human Transport system

The human heart lies between the lungs in the thorax region. It is a conical structure of thick muscular tissue which is protected by a membrane called pericardium. It has four chambers, two upper auricles and two lower ventricles connected to the arteries and veins. Arteries carry blood to the different parts of the body from the heart. Veins bring blood from the different parts of the body to the heart. Arteries are connected to the veins through a net work of capillaries.



Internal structure of Heart (Arrows showing course of circulation).

Fig. 11.5 The heart and associated blood vessels and Capillaries.

The heart pumps blood by the contraction and relaxation of the muscles. This is called heart beat. Do you know how many times our heart beats per minute ? It is 70 times. Doctors use stethoscope to count heart beat. This pumping of blood can be felt as regular jerks near neck, wrist and temples. This is called pulse.

The right side of the heart receives deoxygenated blood from various parts of the body and pumps it to lungs for the exchange of oxygen and carbon dioxide. The left side of the heart receives oxygenated blood from lungs and pumps it to all parts of the body to distribute oxygen and other materials. The deoxygenated blood returns to the right side of the heart which is again pumped to the lungs.

Blood carries nutrients, food, gases, hormones and waste materials. Blood is a liquid tissue and has different kinds of cells to perform different functions. Red blood corpuscles carry oxygen, nutrients and hormones to all parts of the body. It also removes carbon dioxide and other waste products from the body cells. White blood corpuscles fight against disease causing germs. Another kind of blood cell called platelets are mainly responsible in clotting of blood. All these blood cells are floating in a liquid called plasma. The plasma contains many proteins which help in clotting and gives immunity to the body in defending against the disease causing germs.

Loss of blood from the wounds sometimes demand blood

transfusion.

During accidents, injury or during an operation one may loose a lot of blood. In such cases blood from healthy persons are transferred to the person who is in need of blood. But blood of one person cannot be transferred to all persons. Blood of all persons fall in certain groups. The four main blood groups are called A, B, AB and O.

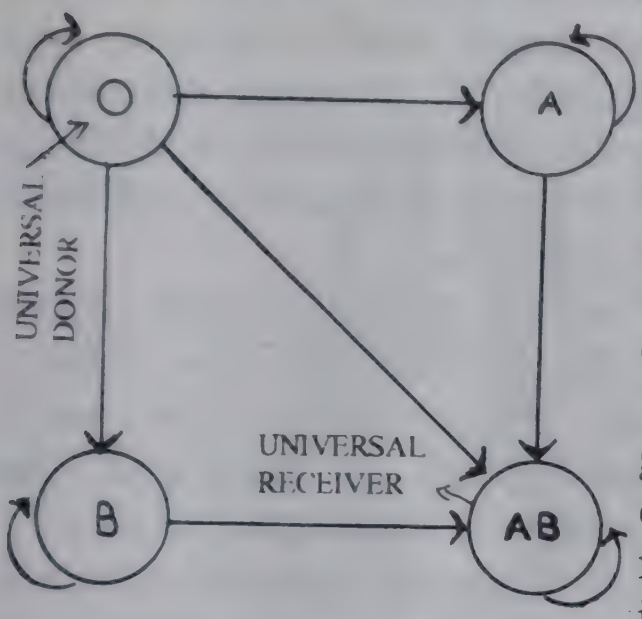


Fig 11.6 Matching blood types

Only blood of certain groups would match. If it does not match it proves fatal as the blood clots inside the blood vessels. Fig. 11.6 shows the blood types that can be matched safely and can be donated.

Blood is also stored in the blood banks to supply blood during emergency.

Activity: Find out the blood banks in your area.

The removal of waste products formed in living body is essential.

During the life processes such as digestion and respiration, some waste products like carbon dioxide, water, urea, uric acid etc., are produced in the body by the breaking down of the food materials.

Waste materials are toxic to the body. If the concentration of the waste substances increase in the body they become poisonous thereby life of an organism ceases. Therefore these need to be thrownout of the body. This process is called excretion.

Various organs are involved in the removal of the wastes

The way of removal of waste products vary in different organisms. In small aquatic organisms like Amoeba, hydra, the waste products can diffuse into water directly from the cells in which they are produced. But in animals with complex body structure diffusion of the waste substances outside the body is not possible. Hence they have different methods to remove waste products produced by different organs of excretion in different animals.

The planarians (flat worms) have excretory canals consisting of flame cells. The Earth worm have tubular structure called nephridia. Which excrete the waste products through small openings on the body wall. The insects throw their waste through the malphigian tubules.

However the most highly organised excretory system is present in the vertebrates. In them, the body wastes are separated from useful substances in the kidneys. Sometime both liver and kidneys take part in the removal of the wastes.

Human beings also have various organs in removing the waste products out of the body.

a) The undigested waste is eliminated by the digestive canal through anus in the form of faeces,

b) Carbon dioxide is excreted out through lungs and nose,

c) When the digested food is supplied to the tissues, the waste products like urea, some other salts and water which are produced in the liver are eliminated by the excretory organs like skin in the form of sweat and kidney in the form of urine.

Plants get rid of waste materials as gases, liquid and by storing them as solids .

Plants do not have special organs to get rid of the waste substances, but there are different methods. A part of the

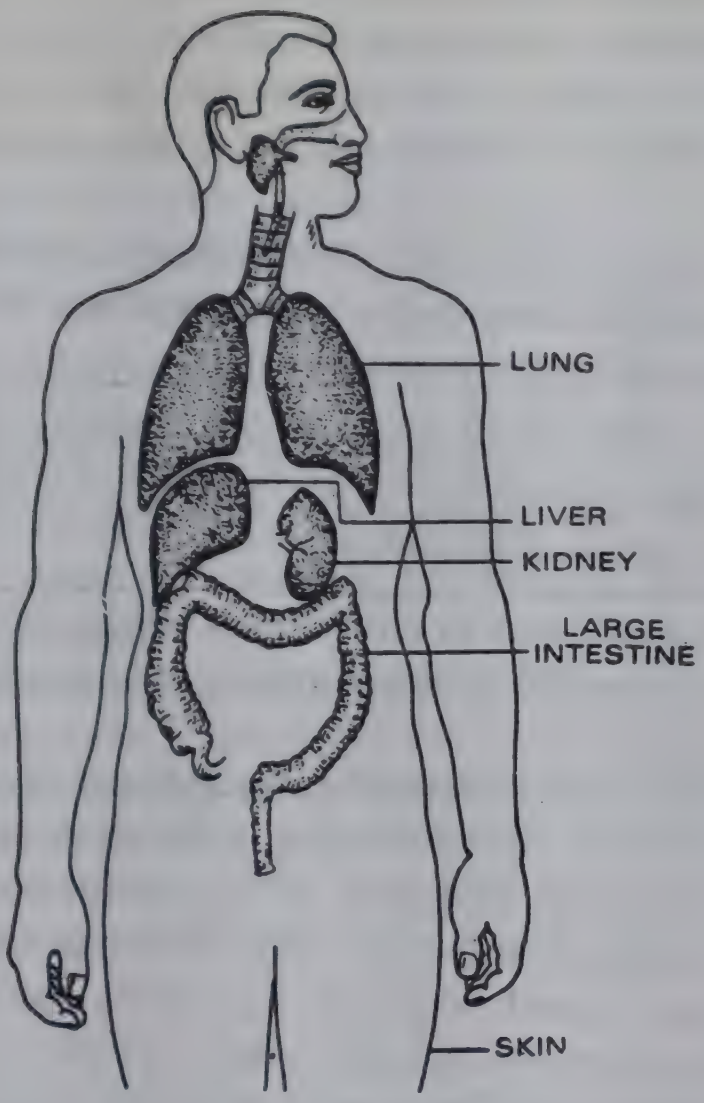


Fig 11.7 Some of the organs used by human body for waste removal

carbon dioxide and water produced in the respiration is made use of in photosynthesis. of the oxygen liberated during photosynthesis is made use of in respiration. Some waste products have to be thrown out of the plants body.

In lower plants and aquatic plants, waste products diffuse out through the cell membrane.

In higher plants carbondioxide, oxygen and water are released through stomata of leaves and lenticells of stems. In some plants extra water along with minerals is excreted

through certain glands at the edges or the tips of the leaves called hydrathodes. Some waste products formed during photosynthesis collect in the leaves and bark of the trees. When the leaves and barks are shed, the waste go with them.

In plants some wastes are stored in the solid form. For example - rod like calcium-oxalate crystals are found in dry scales of onion.

Know this:- Some of the plant secretions which are waste products such as rubber, gums, resins, eucalyptus oil, sandalwood oil are useful to us.

Animal wastes such as cowdung is useful as a fertilizer. In villages, it is used to produce gobergas which is used as a fuel.

The parts and processes of an individual are controlled and coordinated for effective living in the environment.

Imagine yourself that you are crossing a road and a vehicle is coming across your way. What would be your reaction? You would stop. If not there would be an accident. Here your eye should detect vehicle's arrival and the muscles of the legs should stop the movement. Eyes and legs should co-ordinate with each other.

All life processes are inter related.

In a multicellular organism, every organ system is concerned with a definite function but no system can work in isolation. They are interrelated. If we take food, it has to be digested. If the digested food is not oxidized by the process of respiration, no energy will be liberated. If there is no transport system, then the food and oxygen which we take in would be a waste as it is not supplied to the cell to release energy. If the kidneys do not work properly, the blood will be full of poisonous substances and the organism dies.

All the life process and organs need co-ordination

Life processes depend upon one another and are controlled in a systematic way. When you are thirsty, you drink water, when you see a snake you run away, when you see sweets, your mouth salivates. In other words your entire body responds as a whole to a given stimulus. To perform this function, the corresponding system, organs, tissues and cells must work in a coordinated way. We react to the changes occurring inside and outside the body. The changes (seeing snake) are called stimuli. The corresponding reactions (running) are called response.

Co-ordination in animals is effected by the Nervous system and hormones.

The control and co-ordination in animals is carried out in two different but related systems. One of these is nervous system. It is a very fast action system. It contains a series of nerve cells connecting all parts of the body.

The vertebrates have a highly organised and well developed nervous system. In human beings the nervous system consists of brain, spinal cord and nerves and the sense organs are eye,, ear, nose, tongue and skin. We see, hear, smell, taste and touch through sense organs. They send the message to the brain. The brain has different regions to detect different senses. Brain also directs the other organs to do their functions depending upon the stimulus received. Look at the Fig 11.8 where you find the different areas of human brain connected with different functions. There are certain other regions in the brain

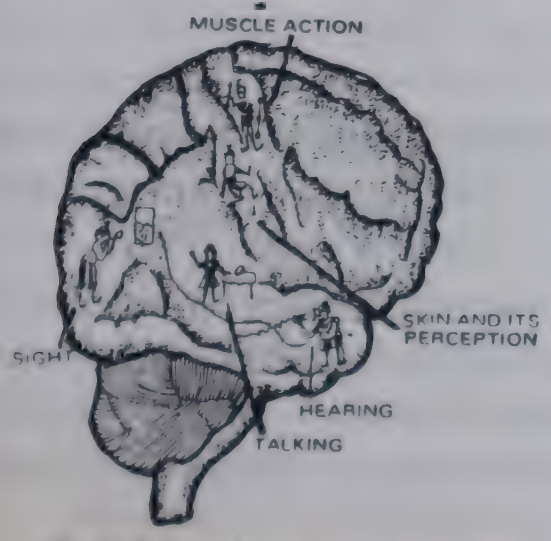


Fig 11.8 Location of brain functions

which controls the involuntary activities like digestion, respiration, etc.

The brain receives the messages from the sense organs through the nerve cells and gives action messages through certain other nerve cells to the muscles and glands.

In addition to the nervous system there is one more communication system in our body called endocrine system. This system consists of ductless glands which produce some chemicals called hormones. These hormones act as messengers and bring about changes in the functioning of the different organs of the body.

In plants co-ordination is effected by the hormones.

Plants differ from animals in having no nervous system. Therefore quick responses are not seen in plants. A few plants however exhibit rapid movement. For instance if you touch the leaflets of Mimosa pudica ('touch me not' plants) all the leaflets drop down.

Plants achieve the responsiveness and co-ordination through a system of chemical co-ordination. These chemicals are called the plant hormones. The reaction of plant cells due to the external stimuli like light, water is due to the effect of hormones. The best known plant hormone is auxins which are in the meristematic tissue of the shoot and root system.

Activity:- Keep a potted plant in a dark room with light only on one side (right side). After some days we can notice that the shoot tip has bent towards the light why?
This is because much of the harmones (auxins) secreted on the right side of the shoot tip (where light falls) is destroyed by the light where as hormone remain on the left side. Therefore shoot tips cells grow much on left side and bends towards light.

Movement of the whole body (Locomotion) or its parts are important for various processes and activities.

Movement is the general characteristic of living organisms. The movement may take place in the whole body or any part of the body.

This movement of the whole body or its parts are helpful in carrying out various activities of the body.

Movement is caused by various stimuli.

Organisms respond to stimuli by moving towards or away from the stimuli. These movements may be due to gravity light or other environmental factors. You have seen that the stem of a plant always grows upwards. This is the movement of the stem towards the source of light. The root grows towards the earth. These growth movements are termed as tropics. Flying of insects towards light is called taxis.

Movement in higher animals is effected by coordinated action of muscles and bones.

We walk with the help of our legs. Fish swim in water, birds fly in air, snakes creep on the earth. Here animals use different organs like legs, wings which are made up of muscles and bones. These bones support the muscles in movement.

Co-ordination in such movements is brought about by nervous system. Animals like Earthworm, insects use only muscles for movement. Such movement is known as muscular motion.

Mechanism of movement varies in different organisms.

Mobility is the key feature of animals. In contrast to plants, most animals are capable of movements which results in locomotion. The locomotion is essential for the successful survival of organisms in the environment.

Four basic types of movements may be seen in animals.

1) The intracellular movement not resulting in locomotion which may occur in cell division.

2) The amoeboid movement. Here the directional protoplasmic flow results in pseudopodium formation and results in the locomotion of the cell as in amoeba .
3) The movement seen in Euglena and paramoecium which occurs by the lashing of flagella or cilia.
4) The muscular or contractile motion which we see in multicellular animals.

Movement helps in dispersal or migration and in seeking food and shelter.

Have you ever observed plants growing in different places? How do they move? The seeds of plants move in different ways. Take the example of castor seeds. The seed coat breaks open and the seeds are thrown to distant places. Some times seeds move with the help of air, water, insects, etc. Movement also helps in dispersal of seeds which enables them to get sufficient water and minerals for their growth.

All the animals have to get food from their environment. So movement helps them to search for food. When the ponds get dried, the animals move to different places in search of water. When there is fire in forests, the animals move to safer parts of the forest. Some animals move into caves to get protection from cold. Have you seen birds migrating from different countries? Why do they fly long distances? It is because to avoid seasonal changes like cold, and in search of good climate, food, shelter and for reproduction.

Know this : Modern man is the only animal capable of moving with legs. He has adopted his hand movement in the use of tools and weapons.

Reproduction ensures continuity of life.

Every organism takes birth, grows and performs various life activities and dies. Yet its generation continues. Although so many people die, we could see an increase in

population, why?

Living organisms perpetuate by producing their own kinds.

You might have observed that a cat gives birth to a kitten which resembles its mother. A mango tree gives rise to mango tree, but not an apple tree. Every organism grows and dies due to aging, due to harmful environmental changes, enemies or diseases. In order to continue their species, the organisms have to reproduce new individuals before they die. This ability is called reproduction.

Organisms reproduce by various means

You know that birds, snakes lay eggs from which young ones hatch out. whereas cow gives birth to a calf and a dog to pups. In the same way, in lower organisms, cells divide to give rise to new organisms.

There are two major methods of reproduction, asexual reproduction and sexual reproduction.

Asexual Reproduction and its types

In asexual reproduction, offsprings arise from a single parent. It does not involve fusion of nuclei from two cells. There are 5 kinds of Asexual reproduction.

1. **Binary fission:-** In organisms like amoeba, paramoecium, algae, first the nucleus divides into two following the pinching of the cytoplasm in the middle. This results in forming of two cells which are alike.

In spirogyra the newly formed cells remain together. As division continues, the cells form a long thread or filament. This equal

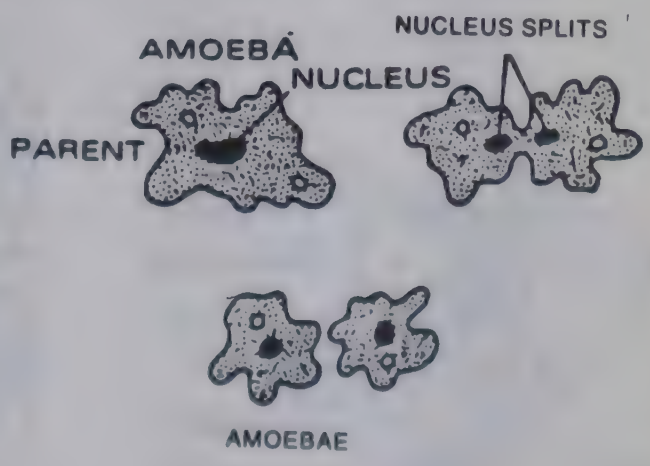
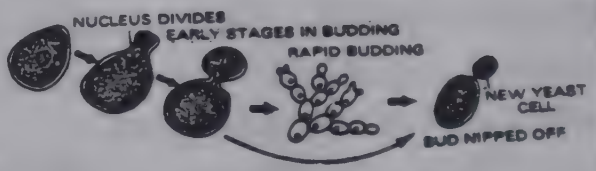


Fig 11.9 Binary Fission in Ameoba.

division of the nucleus and the cytoplasm is called binary fission.

2. **Budding:-** It is a type of asexual reproduction in which a new individual is produced as a bud or outgrowth on an older individual. We find this type of reproduction in yeast cells and hydra.

Activity:- Get some baker's yeast, used in bakery, crumble a small part of it into a small jar with water and add some sugar. Put it in the warm place. Next day take some liquid from the bottom of the jar. Observe under a microscope. You will see many round colourless cells. They are attached in a chain like fashion.



Bud formation in yeast cells.

Fig 11.10 Budding in yeast

3. **Spore formation:-** Many fungi (bread mould yeast)

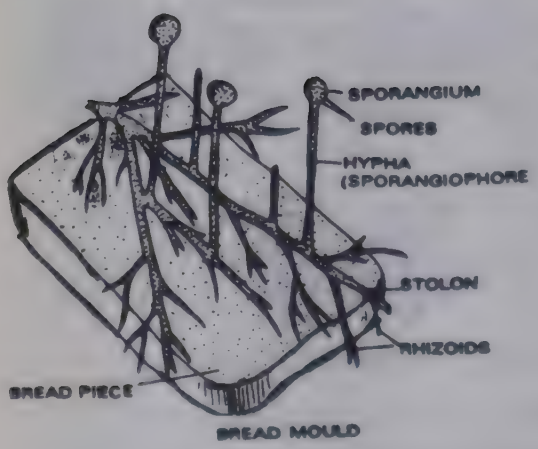


Fig 11.11 Spore formation

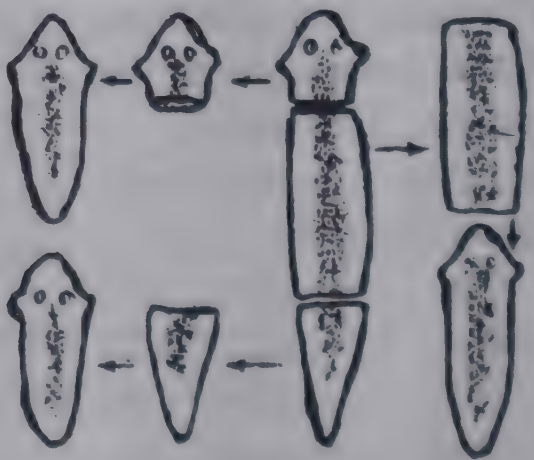


Fig 11.12 Regeneration in Planaria

and bacteria reproduce by spore formation. Spores are microscopic bodies containing a nucleus and a small amount of cytoplasm. They are usually very light with a protective wall around them. The protective coat enables to withstand unfavourable conditions of temperature, moisture or food supply.

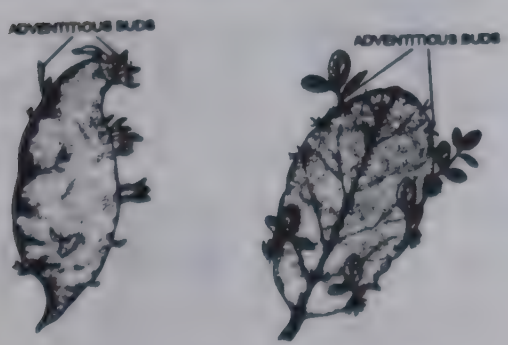
Activity: Place a moist piece of stale bread in a covered jar in a warm place. After a few days, observe it using a hand lens. What do you see?

4. **Regeneration:-** When organisms like planaria or starfish are cut into pieces accidentally, each piece can grow into a new individual as shown in fig 11.12 This ability of a living thing to form a new organism from the parts of the old one is called regeneration.

When you have a cut or a burn, after sometime, the skin of that part is replaced by a new one.

When you try to catch a lizard, it loses its tail. After some time a new tail grows, this growth of the lost part is also regeneration.

5. **Vegetative reproduction** : Many plants reproduce vegetatively. Do you have a croton plant in your house? How did you grow them? From a stem cutting. Asexual reproduction in some higher plants takes place from the pieces of stem, leaf or roots. When such a vegetative part of a plant is used for reproduction, the method is called vegetative reproduction.



Potato Bryophyllum

In some plants like potato, tulip and bryophyllum, the buds found in different regions grow into new plants.

When we eat seedless orange, grape, we wonder how do these plants are grown without seeds. It is done by grafting which is one of the methods of vegetative reproduction.

Some plants and animals reproduce sexually.

Higher organisms reproduce sexually. The sexual reproduction takes place by the participation of two parents.

In many organisms like fish, frog, birds, human beings only one kind of gametes i.e., sperm or ovum is produced in one individual. Individuals which produce sperms are called males and those which produce eggs are called females. Egg cells are produced in ovaries and the sperms are produced in testes. In case of flowers, we find these in pistil and stamen.

In many flowers and certain animals like earthworm both sex cells are produced by the same individuals. Such organisms are called hermaphrodites.

The fusion of sex cells (fertilization) occur inside the female body as in case of birds and human beings. In case of fish and frogs, the fertilization takes place outside the body of the animals.

In case of plants the agents like wind, insect and water help in transferring the pollen grains on to the pistil (pollination). The fertilized egg develops into seeds.

All Organisms Exhibit Growth and Development

Have you ever wondered how a seed grows into a plant within a few days? A new born baby grows into a small child within a year. This process of the formation of specific shapes and patterns by increasing the size of the organism is called the growth and development. There are different ways of growth and development. Observe Fig 11.14

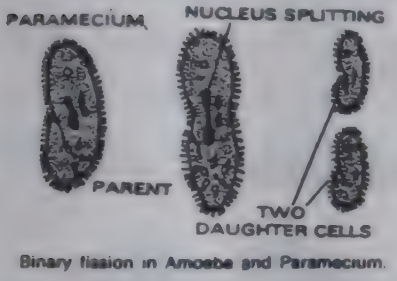
1 In the unicellular organisms the cell grows in size, reaches a stage and then divides into two. (Fig A)

2. In Multicellular organisms, the cells in the tissue grow

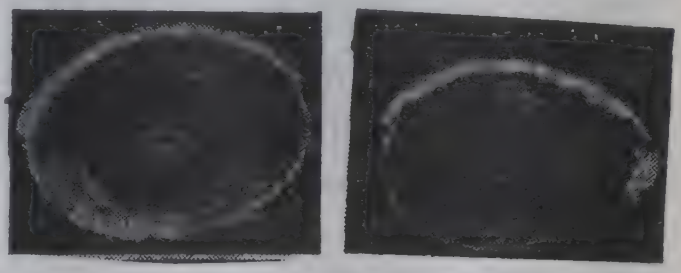
and change their shape and structure according to their specific function and form stomach, kidney, nerves, muscles and so on. Ultimately assume the shape of an individual. (Fig B)

3. Plants exhibit indefinite growth. The growth takes place only in stem tips and root tips. (Fig C)
4. In human beings growth takes place upto 20 to 25 years of age and then stops. (Fig D)
5. Development in some animals takes place in different stages between the hatching of eggs and the formation of adults. (Fig E)

A



Binary fission in Amoeba and Paramecium.



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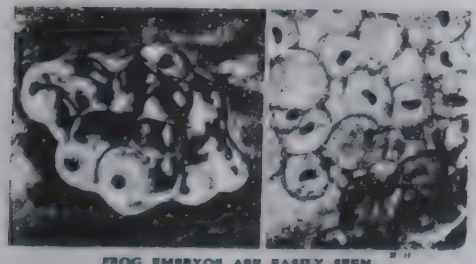
FROG EMBRYOS ARE EASILY SEEN

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E

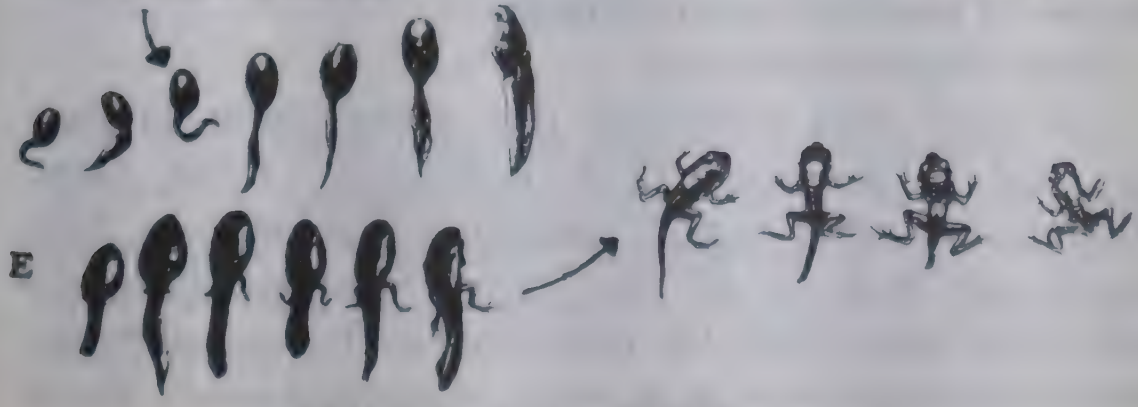

Fig 11.14 Types of Growth and Development

The process of development is interesting in those animals where there are different stages of development between the hatching of the eggs into a stage called larva. and the formation of adult. Such development is called metamorphosis. It occurs in certain animals like frog and insects.

Exercise

1. Enumarate the importance of photosynthesis.
2. Describe the different stages of nutrition.
3. List various excretory organs in man and the waste products excreted by them.
4. How is respiration important for life?
5. Describe blood circulation in man.
6. Mention the types of asexual reproduction.

UNIT - 12

FOOD, HEALTH AND DISEASES

Food is essential for growth and maintenance of life.

All living beings require food to get energy required to perform different functions of the body. Not all substances in the food that we eat are completely usable. For example the cellulose in the cell wall of the vegetables is not used by our body cells. It is thrown out as a waste. The useful materials of food are called nutrients.

Plants Prepare their Food

You have read previously that green plants prepare their food in the form of carbohydrates. From these carbohydrates, other organic materials like proteins, fats, minerals are built up by the plants. After satisfying the needs of the plant body, the remaining part is stored by the plants in the organs like roots, stem, leaves and seeds. These

are used by man and other animals as food.

Animals procure their food from other living organisms

If you think carefully, where your food comes from, you will realise that all our food comes from plants. Much of our food such as cereals, vegetables and fruits are directly supplied from plants. For instance, think that you are drinking milk. We get milk from cow which has eaten grass.

Activity 1: List the animals and the different types of food they take.

We need food because (a) It serves as fuel giving energy and warmth. (b) It enable us to grow and repair and replace our tissues (c) It provides us important substances which control our life activities (d) It keeps us healthy, helping us to fight diseases.

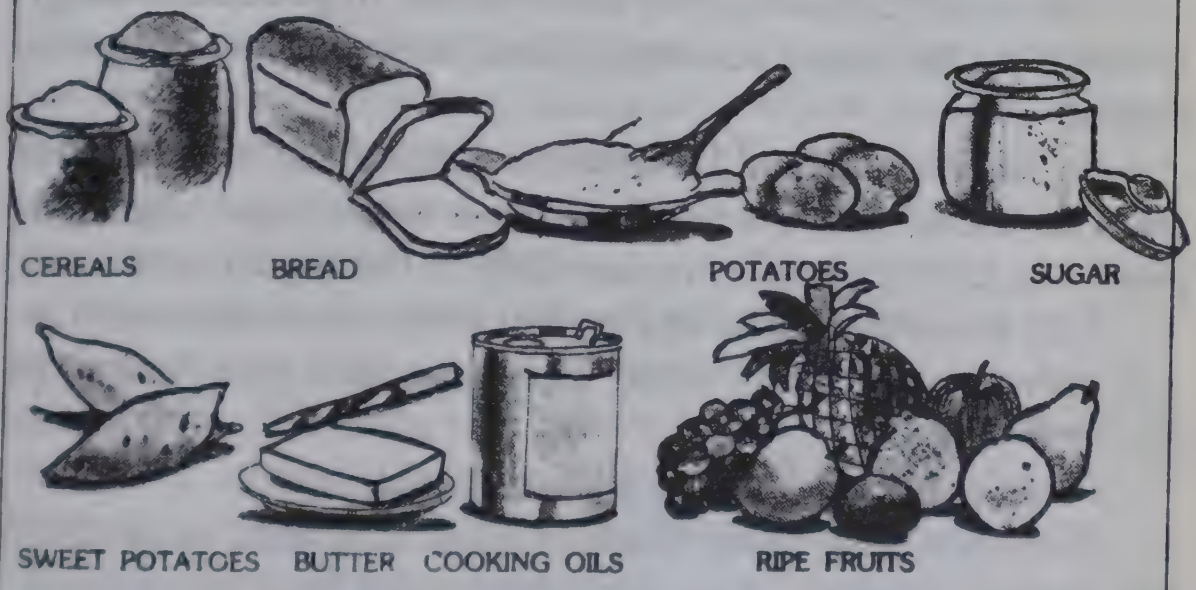

Fig. 12.1: Some common foodstuffs which form good sources of carbohydrates, fats, proteins, minerals and vitamins. You should select the main part of your everyday diet from these four food groups. Identify as many food items as you can.

Food is composed of different types of basic constituents

To carry out the different functions of the body, it is not enough if we consume only one type of food. Our food should be a combination of many nutrients. There are six basic constituents of food which have different functions. They are carbohydrates, proteins, fats, mineral salts, vitamins and water. A lack of any one of these constituents will impair nomal healthy development.

Carbohydrates and fats mainly provide energy

In your body the substance that is used as chief energy food is carbohydrate. They include sugar, starch and cellulose. Sugars are present in milk, fruits and common sugar which we use daily. Starch is present in rice, wheat and cereals. We cannot digest starch until it is cooked. The energy from food is measured in calories.

The main food which we eat in order to produce energy is called staple food. Our staple food includes rice, chapathi, dhal so on.

Butter is an animal fat whereas ground nut oil is a plant fat. The animal fats are solids at room temperature where as plant fats,termed as oils,are normally in the liquid form.

Fats not only give us energy but keeps the body warm as well serves as an energy store. They give taste and flavour to the food we eat.

Proteins help in building body materials.

Our daily food items like rice, dhal, chapathi, vegetables, etc. contain protein. This is an important food constituent. Some protein help in body building as well as repairing of worn out cells of the body. They form structural part of enzymes which control chemical reactions in the body. Muscles, hairs, nails contain proteins. Haemoglobin in the blood is also a protein.

Certain amount of protein is present in most foods. But it is abundant in milk, eggs, meat, fish and pulses.

The body does not store proteins. It uses what it needs and keeps a small amount circulating in the blood. Unused protein is thrown out of the body as nitrogenous waste. Therefore, protein should be a regular part of your diet, if you want to stay healthy. The average man needs about 70 to 100 grams of protein everyday. A very high protein diet is not good for you. It puts a strain on the kidneys whose job is to remove the nitrogenous waste from the body.

Minerals and vitamins help in normal functioning of the body

Our body requires certain salts. Such food materials are called minerals. Table salt which you are using daily is a mineral made up of sodium and chlorine. If a person runs short of salt he gets a sharp pain in his muscles called muscle cramps. Other mineral salts which our diet contains are calcium, iron, phosphorus, magnesium, potassium and iodine. Lack of mineral salts cause deficiency diseases which can be cured by providing necessary salts in the diet. About 4% of our body weight is mineral. The total weight of all minerals that we need daily to make up mineral loss in body wastes is about 30 grams.

Vitamins are a collection of organic substances which are needed in the diet, for the maintenance of normal metabolism. Vitamins are known by the letters A, B, C, D etc. Each vitamin has specific function to do. Certain diseases are caused by their deficiency. Different kinds of vitamins, their sources, importance and diseases caused by them are shown in table 1

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Table 1: Importance of Some Vitamins in Your Diet

Vit-amin	Importance	Where it is found	Diseases caused by Deficiency
A	Helps keep eyes, hair and skin healthy	In spinach, carrots, butter, sweet potatoes, mangoes	Poor vision, bad eyes, night blindness
B1	Helps the digestive and nervous system work well	In eggs, meat, whole cereals, yeast	Beri-Beri Extreme weakness
B2	Keeps the skin and the mouth healthy	In green leafy vegetables, peas, beans, milk	Retarded growth Bad skin
B12	Needed for healthy blood and for proper growth of the body	Mostly in meat and non-vegetarian food	Anaemia - deficiency of red blood cells or haemoglobin
C	Helps resist infections, helps keep teeth, gums and joints healthy	In almost all fresh fruits, specially lime, lemon, orange and gooseberries, guava	Scurvy - swollen gums, livid spots, loose teeth and joints
D	Aids in the normal growth of bones in the young	In fish liver oils, milk. Body exposed to sunlight produces a little bit of Vitamin D	Rickets - soft bones, spine, and bow legs
K	Helps in the clotting of blood	In green leafy vegetables, tomatoes, egg yolks.	Excessive bleeding after injury

Vitamins are not formed in the body and have therefore to be supplied with the diet.

Water is essential for the use of other nutrients and is a basic constituent of food

We consider water as one of the essential items of food. Why? About two - thirds of our body is composed of water. All chemical reactions in the body take place in the presence of water. Water is necessary to keep up the temperature of our body, to facilitate digestion. It is the medium of transport in blood. Since we continuously loose water while breathing, sweating and excreting, it must be replaced. Death results in three or four days if there is no intake of water but we can survive without food for several

weeks as it is stored mainly in the form of fat that can be used.

The source of much water is food, all of which contain some water. For example green vegetable contains 90% of water and milk 87% water. The rest of water is supplied by liquids. We must drink at least a litre of liquid everyday .

Some amount of roughage in food is also required

There are certain food items required by our body even though they do not either produce energy or helps body building. They are called roughage.

One such food material is cellulose which is found in the cell wall of plants. It is a kind of carbohydrate which is tough but cooking makes it soft. We cannot digest it as there are no enzymes to break it, yet it performs an useful function of mixing together with the undigested matter and forms roughage. It keeps food moving along the gut and prevents constipation. Roughage stimulates the muscles to contract pushing the faeces along and keeping them moving. Green vegetables with fibre in them such as greens, cabbage, lady's finger and beans are important source of roughage.

Some compounds or constituents of food cannot be prepared by living organisms

Animals though synthesize some proteins, they should depend upon plants for several important amino acids used in protein building. Similarly animals are very greatly limited in the synthesis of minerals and vitamins. They should obtain them either directly or indirectly from plants.

Different food items are rich in different constituents

You see variety of food materials everyday. As different food items are rich in different constituents, our meals should be planned according to the body needs.

Some food items are enriched by the addition of vitamins. Bread is enriched by adding some synthetic

vitamins and mineral iron. Oleo margarine is made equal to butter by adding vitamin A concentrate.

Different items of food in right combination form balanced diet

For being healthy and strong, you should have a balanced diet.

Balanced diet varies with age and nature of work. People doing heavy work need more carbohydrates than those who are sedentary. Growing children need more proteins than adults. Costly food does not constitute balanced diet. Balanced diet is obtained by judicious selection of all food constituents. A careful watch on diet play a most important part in keeping body healthy.

Choice of food should base on its food value rather than fads

You have studied all the constituents of food and their requirements for the body. If we take an example, a banana has got a good amount of all the food constituents when compared to the grapes. Similarly ground nuts are as good as cashewnuts. Yet when the grapes season arrives, we pay more money to buy grapes. Just because it is expensive, it does not make a better food. The idea that some things are costlier and difficult to get in all seasons, we should not consider it as a good food. Such a wrong idea about food is called a food fad. For example, Eating lot of ghee is good, eating onion, garlic is bad. These statements have no scientific basis.

Good health requires right type of food

When an inadequate amount of food is consumed, it leads to under nourishment. This condition of health is called malnutrition. Such persons will be weak and do not have strength. There is another disease called Anorexia nervosa caused by a lack of appetite (no desire to have food). Such individuals will be pale, thin and more easily

attacked by diseases. This is a nervous complaint which needs psychological treatment where patient is encouraged to eat.

Deficiency of carbohydrates make the body weak

You know that a student of your age needs about 2200 to 2500 calories daily i.e. you need about 320 grams of cereals per day. A diet that has less than this, is deficient in carbohydrates. Such diets usually cause weakness in the body. Marasmus is a deficiency disease in babies and young children due to carbohydrate deficiency. The body has a shrunken appearance. Growth is slow and dehydration takes place. On the other hand too much of carbohydrates do not build strength but leads to inactivity and lack of physical fitness.

Lack of proteins cause serious disorders

What happens if a person does not eat enough protein? If he is a grown up person, it results in poor health. For a growing child, it becomes restless and miserable with weak muscles. This condition is called Kwashiorkor which means the rejected one. This disease occurs in children when the mother can no longer feed the child. This can be cured by providing food which includes beans, ground nut, etc.

Lack of vitamins cause stunted growth.

The amount of vitamins needed for the body may not fill a spoon, but they are important because they cannot be synthesized in the body and they regulate the body activities.

If you do not get different and sufficient amounts of vitamins in your diet, you get vitamin deficiency resulting in stunted growth.

a) Deficiency of Vitamin A causes night blindness, where there is difficulty in seeing dim light. Vitamin A deficiency result in damage to membranes in the eye.

b) If Vitamin B is lacking, it causes Beri-Beri which results in lack of energy, getting tired easily and pain

along nerves.

c) Scurvy is caused by lack of vitamin C which results in bleeding of gums. Lemon or orange juice, fresh vegetables bring quick cure.

d) A lack of Vitamin D causes rickets which results in bowed legs or in poor growth of breast bone and ribs.

Deficiency of minerals cause defective teeth

A deficiency of calcium results in decaying teeth and white flocks in the finger nails. In the same way, a lack of iron compounds in the diet cause anaemia. This condition is caused by not enough red cells being made.

Food needs proper preservation

You know that many crops are seasonal. Food from them must be preserved for all the year round supply. Proper food storage is important to prevent spoilage.

Both cooked and uncooked food gets spoiled if kept for a long time, hence to be preserved

Cooked food like rice, bread etc if kept for a long time gets spoilt due to the action of microbes. Likewise uncooked food like wheat, pulses are also attacked by insects, fungi, rats, etc. All these result in making food poisonous, contaminated and harmful to health. Hence it has to be preserved.

Food grains should be kept in closed containers adding some chemicals. Spreading the grains in sunlight, do not allow microbes to grow on dried food. Modern techniques should be employed in granaries such as constructing cement walls so that rats cannot enter.

By cooking food, the food becomes safer to eat and the microbes in them are killed due to high temperature. After cooking, it can be preserved in many ways like boiling at times, keeping in refrigerators, where the multiplication of microbes stops below $5^{\circ}C$. Some cooked food like milk, meat etc, can be canned. By adding some chemicals like

sodium benzoate, jams and fruit juices can be preserved. Potatoes, bananas and pulses are cooked and prepared as chips and papad.

Activity 4 : Take an earthen pot. Fill one - fourth of pot with moist sand. Cover the pot with moist cloth. Now if food stuffs are kept in it, they won't get stale soon. This is improvised Fridge.

Spoiled food and contaminated water cause disorders and diseases

What happens when you eat spoilt food? You may feel like vomiting, stomach ache, diarrhoea and fever. This is food poisning.

The pond water used by the people for different purposes in a village is unsafe as it contains many undesirable substances called contaminants. Such water causesharm to us, as microbes grow largely in it. The most common diseases caused are typhoid, cholera etc. Such water should be purified before use.

Healthful living depends upon hygiene, sanitation and habits of people.

Our health is not only affected by unbalanced food but also by diseases caused by various reasons. In order to get rid of the diseases either we should take medicines or prevent it by keeping the environment clean and hygienic. Prevention is better than cure.

Health disorders result from malfunctioning of the body

All human beings with very few exceptions often suffer from health disorders like headache, fever, pain in legs, hands etc. These may be caused by the malfunctioning of the body. This may be due to the infection caused by germs or due to improper food habits or over strain and the like.

Diseases also cause disorders

Health disorders are caused mainly due to some diseases. For example, when a person is suffering from cold, cough and fever continuously he becomes weak and may lead to pleuracy or Tuberculosis.

Some diseases are communicable and some are non communicable

Diseases which affect human beings are of two types. Those which can and those which cannot be passed from sick to healthy individuals. Those which spread from one to the other are called communicable diseases. They are caused by micro organisms like virus, bacteria, protozoans etc. Some of the disease caused by them are small pox, polio, malaria, etc.

Activity 5: Identify as many communicable diseases in your locality.

There are some other non communicable diseases. Prominent among these are conditions caused by nutritional deficiencies like scurvy, rickets, inherited disorders like sickle cell anaemia, endocrine disturbances. Ex: diabetes and some allergies. The other diseases are blood pressure, peptic ulcers, heart diseases and various forms of cancer.

Disease causing organisms are transmitted through air, water, wind, physical contact and vectors.

The disease causing organisms cannot move independently. They need help from other moving materials like wind, water, air, insects, animals or human beings.

Disease causing microbes are easily transmitted through water as it is essential for the survival. Diseases like typhoid, cholera are transmitted through water.

Diseases like cold, cough, tuberculosis, etc. spreads through air when the persons suffering from these diseases cough or sneeze the microbes get into the air and spreads.

Many diseases like eczema, Aids, etc., spread by direct contact or by using things used by the patients.

Many serious infectious diseases are spread by insects. For Ex: Cholera by housefly, plague by rat fleas and so on.

Pollution of environment results through air

As the forests are being destroyed the atmosphere gets polluted as carbon dioxide percentage increases in the air. The smoke rising from vehicles, factories, burning of fuels cause air pollution. The microbes living around us also pollute air resulting in environmental pollution.

Personal hygienic habits and environmental sanitation also determine individual and community health

Personal hygienic habits include keeping our body, clothes, food, water and our surroundings clean.

Brushing teeth, taking bath everyday, using clean clothes keep us clean. Keeping our bathrooms and latrines clean by timely spreading of dettol or phenyl, bleaching powder, etc., spraying of DDT and other germicides kills the larvae of mosquito and housefly in the drainages. Use of latrines helps in environmental sanitation. One should have proper ventilation at home. Water should not collect near the houses. Factories should be away from the residential areas. Trees should be planted to get fresh air.

Activity 6: Prepare posters like the following ones and put them in the school and in your locality

1) Throw wastes in covered dust bins

2) Do not spit on road sides.

3) Keep your environment clean to remain healthy.

Some personal habits such as smoking, drug addiction leads to health hazards

The burning problem of modern days is that people indulge in heavy smoking, chewing tobacco, and consuming drugs. What happens if we smoke? The lungs and other respiratory organs may get damaged leading to cough, lung

cancer, tuberculosis, etc. It has been proved that smoker in later days gets affected by cancer. Drug addiction is also a serious problem among students. If one gets used to it they cannot give up the habit easily.

Health spoils due to adulteration of food

Due to increase in population there is great demand for food. Prices are going high. This has given rise to many social evils like food adulteration. Many times adulterated glucose, milk powder and life saving drugs have taken many innocent lives. Contamination of food stuffs and oil cause many allergies. There are many centres to check adulterated food and analyze the amount of adulteration if complaint is lodged. Above all every one should think that such evil acts cause danger to the lives of many people. One should be humane and sincere towards their fellow men. This only can prevent people from causing harm to the society.

Exercise

1. Why do we need food?
2. Name the basic constituents of food.
3. Fats not only give us energy, but also perfom certain other functions. What are they ?
4. What do you mean by roughage? Give any two sources of roughage.
5. What is a balanced diet? Why is it essential?
6. What is food fad? Explain with an example.
7. What are communicable and non communicable diseases? Give examples.
8. What are the different ways of spreading disease causing organisms?
9. Suggest any two methods by which we can keep our surrounding clean.
10. How is smoking injurious to health?
11. Adulteration of food spoils our health. How?

UNIT 13

SOIL

Every one of us would like to have a small garden in front of the house. We get fresh air. The flowers, fruits and plants make garden a pleasant place. However, there is something which makes it possible to have a garden. It is the soil which is often over looked and not taken care of properly. We depend on the soil for our food and shelter. In fact the whole of plant life depends on the soil.

Soil is the top most layer of the earth. There will be no plants without soil. Plants obtain nutrition from the soil. It is the home for many living organisms. Animals live on plants. Hence soil is very important for life to continue on earth.

Constituents of soil

You come across many trenches being dug for construction of a building or sinking a well. Carefully observe the inner sides of the trench. You will find different coloured layers of the soil.

There are three distinct layers in the soil. The uppermost layer contains a lot of decayed plants and animal remains called humus. This layer is soft and porous. It can hold water. The roots of plant obtain the water and minerals from this layer. In fact it is the humus which makes the soil fertile. This layer is called "Top soil". It is the home for worms and insects.

The second layer is harder than the top soil. It contains minerals which are soluble in water and very little humus. This layer is called 'Sub soil'. The third layer is very hard and difficult to dig with ordinary spade. It consists of pieces of rocks. There will be cracks and crevices. The rocky layer beneath this is called bed-rock.

Soil is made up of stones, sand, clay and loam. Stones

are small pieces of rock. They are larger than the other parts of the soil. They are of different shapes and sizes.

The soil on the beach is mainly made up of sand. It does not hold water. Silt particles are smaller and clay particles are too small to be seen separately.

Activity:- Take a jar and fill it with water. Add a handful of garden soil to it. Allow the soil to settle in the jar. Observe carefully. Record the observation. Find out whether the soil in your garden has more clay or sand in it. Does it contain humus?

The capacity of a soil to hold water depends on the type of soil particles and the amount of humus present in the soil. A soil that holds water is said to be porous. A mixture of sand, salt and clay is called loam soil. It is also rich in humus.

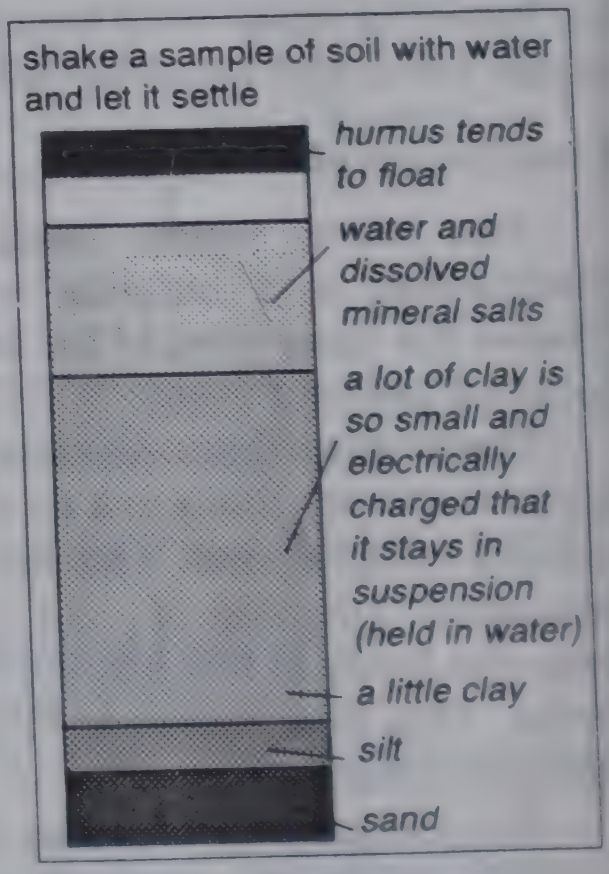
shake a sample of soil with water and let it settle
humus tends to float
water and dissolved mineral salts
a lot of clay is so small and electrically charged that it stays in suspension (held in water)
a little clay
silt
sand

Fig 13.1 Soil testing

Soil samples collected from different areas have different colour, texture and particle size. The colour of the soil indicates the presence of certain chemicals in it. For example, the red colour of the soil is due to the presence of oxides of iron. The black soil may chiefly contain humus and water. The texture of the soil depends on the particles. You must have observed in

your experiment that more of clay makes the soil slippery whereas more of sand makes the soil rough.

Formation of Soil :

The formation of soil is very interesting to study. Rocks must have broken into smaller pieces over a very long period due to earthquake and volcanic eruptions. The formation of soil is a continuous process. The process of breaking the rocks to form soil is known as weathering of rocks. It has been taking place for millions of years. The chief agents of weathering of rock are wind, rain, running water, Sun and ice.

Wind exposes fresh rock layers by blowing away the upper layers. The soft layers of the rock are worn away. This results in the formation of a number of cracks and holes in the rock. When it is exposed to rain, water enters the cracks in the rocks. During winter this water changes into ice and expands. This results in the breaking of the rock into smaller pieces. Running water will further break these pieces into very small particles of sand and pebbles. When the climate is very hot the rock gets heated, sudden cooling of the hot rock takes place either due to rain or fall in temperature. As a result the rock breaks into smaller pieces. Thus change in the temperature or climate help in the formation of soil. The rock particles get transported from one place to another place due to wind and water.

Soil as a natural resource

Many biological processes take place in the soil resulting in the enrichment of the soil. The micro organisms like algae, fungi, bacteria and single celled organisms grow in the soil and die in the soil. The roots of plants penetrate the lower layers. They also enter the cracks in the rocks and help in weathering of the rocks. The plants remove water

from the soil and absorb the various nutrients. When the plants die and decay the chemicals are returned to the soil.

Some of the other living organisms in the soil are insects and worms. Charles Darwin, a great English Scientist recognised the importance of earthworms in the soil. The earthworms make burrows in the soil and allow air to reach the roots of plants. They feed on decayed matter. The worm castings make the soil fertile. When these living organisms die and decay, the fertility of the soil will increase.

The minerals required by the plants can be obtained from the soil water. The minerals dissolve in water and they are made available for the plants. The plants require a continuous supply of water for preparing food and keeping the tissues alive. Therefore, the soil which supplies right quantity of water can support crops.

Sandy soil does not hold water. On the other hand clay soils become water logged and there will be no air space. Most of the plants do not grow in soil made up of only sand or only clay. The soil must contain humus. A loamy soil holds water and also provides airspace for the plants. It is the best type of soil for crops.

The rain water reaches the surface of the earth. A part of it evaporates and some of it drains down slopes and reaches tanks or rivers. But fortunately most of it seeps through the soil and reaches a hard bedrock or a layer of clay. The standing water is known as water table. The water table will be only a few feet below the surface during monsoon. The level of water table will be very low during summer. The depth of the water table also depends on the nature of the soil. This is the water we get when wells are sunk.

Often we think that the water which has drained through the soil is lost and the plants do not get it. Actually water rises up through the soil just like oil rising up in a

wick. The rising up of water through tiny spaces is known as capillaries. Thus soil makes water available for plants.

Soil is also useful in making building materials like bricks, tiles, cement, concrete and mortar. It is the chief raw material for making pottery, glass and porcelain (crockery).

Soil Erosion :

You must have observed dust rising when the wind blows. The running water carries the soil along with it. The loss of the top soil, this way is known as soil erosion. Soil also loses fertility if crops are grown year after year without replacing the nutrients of the plants. The soil becomes barren and plants cannot grow. Therefore we must understand the causes of soil erosion and the methods of preventing it.

Wind causes dust storms which carry away soil particles many miles away. If the farm land is not covered by grass or any other vegetation, the top soil is blown away by the wind and it is ruined. The land becomes bare if forests are destroyed and animals are allowed to overgraze.

Running water, especially flowing over slopes forms furrows. The furrows become wider if water continues to flow. The furrows form a network of its branches and the whole land becomes barren. Heavy rains cause damage to the top soil if the land is not covered by grass. Soil is carried away by running water down the hill slopes. Streams and rivers carry it to the sea. Floods cause erosion of the soil, which lead to crop failures.

It takes many years to regain the fertility of the soil and overcome food shortage.

Conservation of the soil

The top soil has to be protected by taking certain steps to prevent soil erosion and to enrich fertility.

Plants having spreading roots can be grown to cover the top soil. The fast growing grasses are useful in holding the soil in place. The running water in fields must be made to flow in channels. Plants must be grown on the slopes of the ditch to prevent widening of the channel. Drains should be made across the slopes. Humus can be added to the soil. It holds the rain water which otherwise would be lost for the plants.

The soil erosion is very well checked by forests. The trees in the forest send down roots that bind the soil particles. The branches and leaves of trees reduce the force of the rain fall and prevent soil erosion. Afforestation is planting of trees in rows so as to check the direction of wind and water. Thus forests play an important role in conservation of soil.

There are many natural methods of conserving the soil. The farmer has to maintain the fertility of the soil by growing different types of crops. If the same plant is grown year after year, it will utilize the same nutrients and the fertility of the soil will decrease. On the other hand, if different crops are grown the soil will not lose the same nutrients. For example, the requirements of wheat crop will be different from those of potato plant. The pulses and grams will replace the nitrogenous salts used by wheat crop, such crops can be grown alternately.

The soil erosion on slopes can be checked by ploughing furrows. The furrows will hold water and prevent soil erosion. This is known as cantour farming.

If it is hill slope, 'terraces' are built along the hill side. Some times crops are grown in strips to check soil erosion. It is known as strip farming. The stalks of harvested crops

Terracing on hillsides prevents soil from being washed away by water

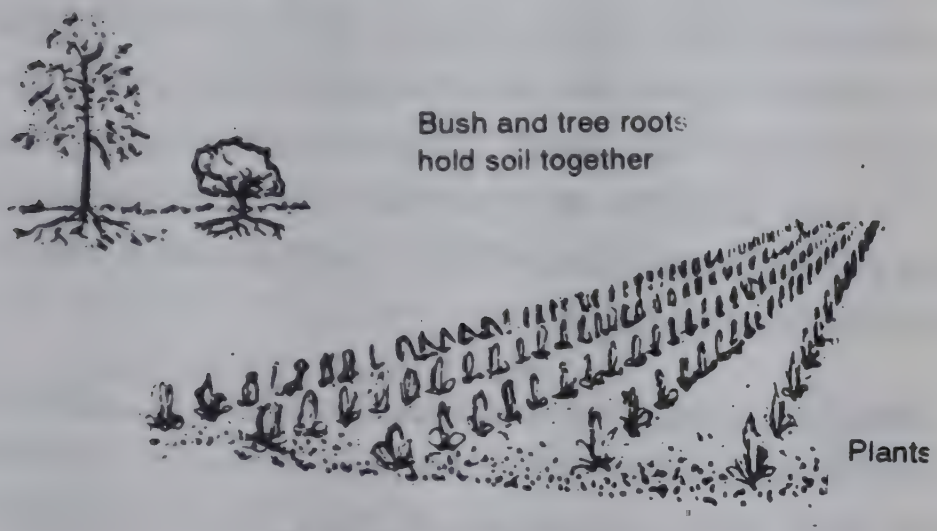

Fig 13.2 Preventing soil erosion

are allowed to remain in the soil until the planting of the next crop. Thus the fertility of the topsoil can be maintained by using natural methods by gardeners and farmers.

Soil pollution can also be caused by other factors like sewage water, contaminated water and chemical water coming from factories and industries.

Exercise

1. What are the characteristics of a fertile soil?
2. What is soil erosion? How is this prevented?
3. What is Afforestation
4. Mention the different methods of farming.
5. What is meant by 'Weathering of Rocks'?

Unit - 14

AGRICULTURAL PRACTICES AND IMPLEMENTS

The term agriculture in Latin means 'cultivating field'. Besides agriculture man started domesticating animals. Some animals like cattle, sheep and poultry became his chief sources of food. He also trained them to serve him in agriculture and transport. As cultivation progressed he learnt to use animals for various other purposes. Some animals became sources of hide, leather, wool and the like for man on the long run.

Forests are our major natural resources, where plants and wild animals are found in their natural environment. Hunting and other activities of man like development of towns and cities have caused a great damage to our forest reserves. No doubt, we require more and more land for cultivation to meet the needs of growing population. But it is equally important to protect the wild life and grow new seafoods. Fresh water and marine plants and animals have to be managed well since they form the major part of our food. Their natural conditions have to be maintained.

The crops must be managed well to improve production. It is necessary to ensure certain conditions for getting food crops. Soil, water and seeds are the primary factors. The protection of crops against pests and weeds, is another condition for getting good crops. Above all, the use of proper implements and agricultural practices determine the quality of the produce.

Agriculture involves a systematic method of managing the crops. Today, one of the most important problems facing our country is the food problem. Naturally, we have to learn not only to increase the food production but also to manage the available resources.

We know that green plants are the chief producers of food. The food producing plants are called farm crops. They can be divided into four major groups. They are cereals pulses vegetables and fodder crops. The chief cereals cultivated in our country are paddy, wheat, maize, barley, ragi and other millets. Pulses and grams are rich in proteins. They also form good food for cattle and horses. Vegetables, fruits and flowers are grown on a large scale in gardens. They are called horticultural crops.

Activity : - 1. Prepare a list of the common crops of India in the form of a table.

2. Make a list of the horticultural crops and classify them as vegetables, fruits, flowers and decorating plants.

You already know that plants require air, water, sunlight and nutrients. The plants obtain nutrition from the soil.

You have already realised the importance of soil in any type of cultivation. A field or a farm, or a garden has to be managed properly so that the yield will be maximum. The basic agricultural practices are common for all types of crops. The basic practices include ploughing, sowing, manuring, irrigating, harvesting and storage.

The particles of the soil must be loosened to hold air and help the roots of plants to easily penetrate. This is

known as ventilating the soil. The loosening of the soil is done by digging and ploughing. It also helps in the growth of soil organisms. The soil forms a protective cover for the roots and soil organisms. Dampness in the soil helps the germination of seeds. It holds the roots in place and provides water and warmth for the plants. You can recall the work of the earthworms here. This is the first step. The turning and loosening of the soil can be done using a plough. The plough may be made of wood or iron.

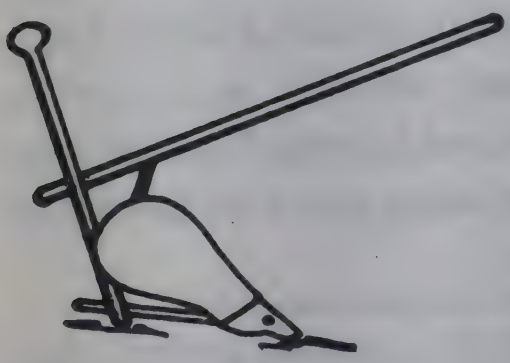

Fig. 1 : Iron Plough

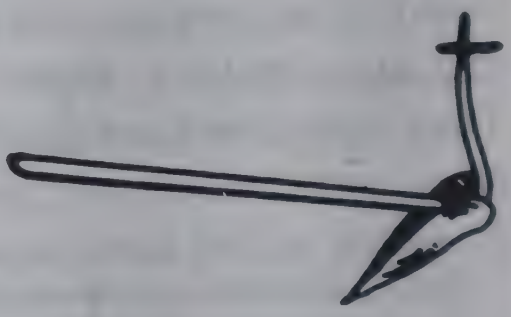

Fig.2 Wooden plough

Large crumbs of mud are broken and the field is levelled. Wooden ploughs driven by animals are used in small fields. Tractors are used in large fields.

When once the field is ready, seeds are sown by hand or by using seed drills. A seed drill consists of a long metal tube with fingers and a funnel attached at the top. The seeds are fed into the funnel. The drill is attached to a plough. The plough makes furrows in the soil and the drill will sow the seeds.

In the case of paddy the seeds are first sown in a plot. They grow into seedlings. The seedlings are then transferred to the field. This is known as transplantation. The advantages of transplanting are, better seedlings can be selected and roots are penetrated deep into the soil. Seeds or

seedlings must be well spaced so that they get sufficient nutrients and sunlight.

You know that soil contains minerals, living organisms and decaying organic matter. Every time we grow crops the nutrients of the soil are used by the plants. The soil loses its fertility and cannot support further plant growth. Therefore it is very important to replace them or replenish by using manure and fertilizers.

Manure consists of animal waste like cow dung, organic remains of plants and animals, human excreta, urine and similar decaying matter. It is rich in minerals.

Farmers usually spread the plant and animal wastes in a big pit. They cover it with mud. The micro-organisms ferment and decompose the wastes in the pit. The decomposed waste is easily absorbed by plants. The manure thus converted is called compost.

Since many years the farmers grow certain crops alternately, so that the nutrients used by one plant is replaced by the other. This is known as 'rotation of crops'. For example, cereals and pulses can be alternately grown. Some times two different types of plants are grown at the same time. This is known as mixed cropping. Farmers also allow the soil to get back its fertility by not growing any crop for a season.

Unwanted plants also start growing in the prepared field. These are called weeds. They take away the water and nutrients meant for crops. Therefore, the weeds have to be removed.

Another important factor which ensures the growth of

a crop is water. For the soil, water will not be available throughout the year. So water has to be supplied periodically from wells, canals or waterways. The large scale supply of water to large fields is known as Irrigation. There are several methods of irrigating the crops. We must remember that all kinds of crops do not require the same quantity of water. The field needs to be irrigated with just the right quantity of water at the right time. Sprinklers are used in gardens and plantations to water the plants.

The farmer has to protect the crop from birds using scarecrow. Other pests like insects and rodents are controlled using chemicals which kill the eggs, larvae and the pests. Such chemicals are called Insecticides and Pesticides. Special sprayers are used to spray the pesticides.

It is a beautiful sight to see the field turn into a green carpet. After two or three months the crops mature and turn yellow. Normally in India farmers grow two crops a year.

Sowing for the first season begins in June-July, This is known as KHARIF CROP. The second sowing begins in October and goes up to December. It is called RABI CROP. Usually rice is grown as Kharif and wheat as Rabi crop. However rice can also be grown as Rabi crop if irrigation facilities are good and the soil is fertile.

The fully grown crop is to be cut and removed from the field. This is known as Harvesting. It can be done by hand using a sickle. In large fields mechanical harvesters are used. The grain has to be separated from the chaff and it is called threshing. A machine called COMBINE is used both for harvesting and threshing. The stem is cut into pieces and stored as hay in the hay stacks. It is the food for cattle.

The grains have to be further separated from the chaff by a method known as winnowing. As a result the seeds fall to the ground and the light chaff is blown farther away by wind.

The storage of grains is another important step in agriculture. The grain must be dried and stored in mud containers or metal containers.

Activity : Visit a nearby village and find out how they store the grains. Know more about BUFFER STOCKS.

Granaries and silos are used to store large quantities of grain. Gunny bags and jute bags are used to transport the grains to the godowns. The grains must be stored dry, otherwise moisture promotes the growth of fungi or moulds which are poisonous. It is also necessary to protect the grains from pests, insects and rats. Nearly 25% of the grains produced is destroyed by rats. Whenever we have good rains, we get bumper crops. It is wise to save food grains whenever possible for future use.

Inspite of our best efforts the food problem is still a major one. It is our responsibility to make sure of safe storage of food grains. The Government is trying to see that each and every citizen get his share of food grains through public distribution system or rationing.

We must be aware of certain dangers in using fertilizers and pesticides without proper guidance and training. They may destroy the soil organisms which are useful to the farmer. The insects and pests may become resistant to the chemicals. Excess fertilizers may pollute not only the soil but even the surrounding water resources. Scientists are now trying to control weeds and pests by using their natural

enemies, thereby the environmental degradation is minimised to a great extent.

Exercise

1. What are Horticultural crops?
2. What are the basic practices of agriculture?
3. What are the constituents of the soil?
4. What is irrigation?
5. What is meant by BUFFER STOCK?

ನೀರು ಗಾಳಿ ಬೆಳಕಿಗೆ, ಹೆಣ್ಣು ಗಂಡೆಂಬ ಬೇಧವಿಲ್ಲ

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ಆಟ ಊಟ ಪಾಠ ಮಗಳಿಗೂ ನೀಡದಿದ್ದಲ್ಲಿ ಒದಗುವುದು ನಷ್ಟ

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ಬೆಳಕಿಗೆ ಸೂರ್ಯನೊಬ್ಬನೇ ಸಾಕು
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ಜೀವನ ಗಾಲಿಗಳು ಹೆಣ್ಣು ಗಂಡು
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1. ವಿಜ್ಞಾನ ಕಲಿಸಿ, ಅಜ್ಞಾನ ತೊಲಗಿಸಿ.
2. ಮಕ್ಕಳೇ ನಮಗೆ ಆಶ್ರಯ,
   ಕಲಿಸುವುದೇ ನಮ್ಮ ಆಶಯ.
3. ರಕ್ತದಾನ ಜೀವದಾನ,
   ನೇತ್ರದಾನ ಪವಿತ್ರದಾನ.
4. ಅಜ್ಞಾನದಿಂದ ಜ್ಞಾನದಡೆಗ,
   ಜ್ಞಾನದಿಂದ ವಿಜ್ಞಾನದಡೆಗ,
   ವಿಜ್ಞಾನದಿಂದ ಸುಜ್ಞಾನದಡೆಗ,
   ಸುಜ್ಞಾನದಿಂದ ಸುಖ ಜೀವನದಡೆಗ ಸಾಗೋಣ.
5. ಹೆಣ್ಣಿಗೂ ಶಿಕ್ಷಣ ನೀಡಿ,
   ಅವಳ ಬಾಳಿಗೆ ರಕ್ಷಣೆ ಕೊಡಿ.
6. ವಿಜ್ಞಾನವನ್ನು ಕಲಿಸೋಣ,
   ಅಜ್ಞಾನವನ್ನು ಅಳಿಸೋಣ.
7. ವಿಜ್ಞಾನದಿಂದ ಪ್ರಗತಿ,
   ಅಜ್ಞಾನದಿಂದ ಅಧೋಗತಿ.
8. ವಿಜ್ಞಾನ ಮುನ್ನಡೆ,
   ಮೂಢನಂಬಿಕೆಗಳಿಗೆ ತಡೆ.
9. ಬೆಳೆಯಲಿ ವಿಜ್ಞಾನ,
   ಅಳಿಯಲಿ ಅಜ್ಞಾನ.
10. ಊರಿಗೆ ಭೂಷಣ ಕಲಾಸಂಘ,
    ಶಾಲೆಗೆ ಭೂಷಣ ವಿಜ್ಞಾನ ಸಂಘ.
11. ಊರಿಗೆ ಬೇಕು ಶಾಲೆ,
    ಶಾಲೆಗೆ ಬೇಕು ಪ್ರಯೋಗಶಾಲೆ.
12. ಕಲಿಯಿರಿ ವಿಜ್ಞಾನ ಮನಸಿಟ್ಟು,
    ಉಪಯೋಗಿಸಿ ಅನವರತ ವಿಜ್ಞಾನ ಶಿಟ್ಟು.

7. ಹಸಿರು ಸೊಪ್ಪುಗಳ ಮಹತ್ವ

★ ನಮ್ಮ ದೇಹದ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳಿಗೆ ಅಗತ್ಯವಾಗಿರುವ ಅನ್ನಾಂಗಗಳು ಮತ್ತು ಖನಿಜಾಂಶಗಳು ಹಸಿರು ಸೊಪ್ಪುಗಳಲ್ಲಿ ಹೇರಳವಾಗಿ ದೊರೆಯುವುದರಿಂದ ಇವುಗಳನ್ನು ರಕ್ಷಕ ಆಹಾರಗಳೆಂದು ಕರೆಯುತ್ತಾರೆ.

★ ಹಸಿರು ಸೊಪ್ಪುಗಳಲ್ಲಿ ಹೆಚ್ಚು ಪ್ರಮಾಣದ ಕಬ್ಬಿಣಾಂಶ, ಕ್ಯಾಲ್ಸಿಯಂ, 'ಎ' ಅನ್ನಾಂಗ, 'ಬಿ' ಅನ್ನಾಂಗ ಮತ್ತು 'ಸಿ' ಅನ್ನಾಂಗಗಳು ದೊರೆಯುತ್ತವೆ.

★ ಸಬ್ಬಸಿಗೆ ಸೊಪ್ಪು, ದಂಟಿನ ಸೊಪ್ಪು, ಮೆಂತ್ಯದ ಸೊಪ್ಪು, ಕೀರೆ ಸೊಪ್ಪು, ಹೊನಗೊನೆ ಸೊಪ್ಪು, ನುಗ್ಗೆ ಸೊಪ್ಪು, ಪಾಲಕ್ ಸೊಪ್ಪು, ಬೆರಕೆ ಸೊಪ್ಪು ಮುಂತಾದ ಹಸಿರು ಸೊಪ್ಪುಗಳು ಸ್ಥಳೀಯವಾಗಿಯೇ ದೊರೆಯುವಂತಹವುಗಳಾಗಿದ್ದು ಕಡಿಮೆ ವೆಚ್ಚದಲ್ಲಿಯೂ ದೊರೆಯುವುದರಿಂದ ದಿನನಿತ್ಯದ, ಆಹಾರದಲ್ಲಿ ಇವುಗಳನ್ನು ಉಪಯೋಗಿಸಬೇಕು.

★ ಗರ್ಭಿಣಿಯರು, ಬಾಣಂತಿಯರು ಮತ್ತು ಮಕ್ಕಳು ರಕ್ತಹೀನತೆಗೆ ಸುಲಭವಾಗಿ ತುತ್ತಾಗುತ್ತಾರೆ.

★ ಇವರಲ್ಲಿ ರಕ್ತಹೀನತೆಗೆ ಮುಖ್ಯ ಕಾರಣ ಕಬ್ಬಿಣಾಂಶದ ಕೊರತೆ.

★ ಕಬ್ಬಿಣಾಂಶವು ಹಸಿರು ಸೊಪ್ಪುಗಳಲ್ಲಿ ಹೆಚ್ಚು ಪ್ರಮಾಣದಲ್ಲಿ ದೊರೆಯುತ್ತದೆ. ಆದ್ದರಿಂದ ಗರ್ಭಿಣಿಯರು, ಬಾಣಂತಿಯರು ಮತ್ತು ಮಕ್ಕಳು ಹೆಚ್ಚು ಪ್ರಮಾಣದಲ್ಲಿ ಹಸಿರು ಸೊಪ್ಪುಗಳನ್ನು ದಿನನಿತ್ಯ ಉಪಯೋಗಿಸಿದರೆ, ಈ ರಕ್ತಹೀನತೆಯನ್ನು ತಡೆಗಟ್ಟಬಹುದು.

★ ಮಕ್ಕಳಲ್ಲಿ ಅಂಧತ್ವ ಬರುವುದಕ್ಕೆ 'ಎ' ಅನ್ನಾಂಗದ ಕೊರತೆ ಒಂದು ಮುಖ್ಯ ಕಾರಣ. ಹಸಿರು ಸೊಪ್ಪುಗಳಲ್ಲಿ 'ಎ' ಅನ್ನಾಂಗವು ಹೇರಳವಾಗಿರುತ್ತದೆ. ಹಸಿರು ಸೊಪ್ಪನ್ನು ಮಕ್ಕಳಿಗೆ ದಿನನಿತ್ಯದ ಆಹಾರದಲ್ಲಿ ಕೊಡುವುದರಿಂದ ಈ ರೀತಿಯ ಅಂಧತ್ವವನ್ನು ತಡೆಗಟ್ಟಬಹುದು.

★ ಹಸಿರು ಸೊಪ್ಪುಗಳನ್ನು ದಿನನಿತ್ಯದ ಆಹಾರದಲ್ಲಿ ಉಪಯೋಗಿಸುವುದರಿಂದ ಬಾಯಿ ಹುಣ್ಣು, ತುಟಿಗಳ ಸಂದಿನಲ್ಲಾಗುವ ಒಡಕು ಮುಂತಾದ 'ಬಿ' ಅನ್ನಾಂಗ ಕೊರತೆಗಳನ್ನು ಸಹ ತಡೆಗಟ್ಟಬಹುದು.

★ ವಸಡುಗಳಲ್ಲಿ ರಕ್ತಸ್ರಾವವಾಗದಂತೆ ತಡೆಗಟ್ಟಲು, ಗಾಯಗಳು ಶೀಘ್ರವಾಗಿ ಗುಣವಾಗಲು 'ಸಿ' ಅನ್ನಾಂಗ ಅವಶ್ಯಕ. 'ಸಿ' ಅ ಅನ್ನಾಂಗ ಹಸಿರು ಸೊಪ್ಪುಗಳಲ್ಲಿ ಹೆಚ್ಚಾಗಿ ಸಿಗುತ್ತದೆ.

★ ಮಕ್ಕಳ ಬೆಳವಣಿಗೆಗೆ ಬೇಕಾದ ಸುಣ್ಣದಂಶವೂ ಹಸಿರು ಸೊಪ್ಪಿನಲ್ಲಿ ದೊರೆಯುತ್ತದೆ. ಆದುದರಿಂದ ಹಸಿರು ಸೊಪ್ಪುಗಳನ್ನು ಬಳಸಬೇಕು.

ಹಸಿರು ಸೊಪ್ಪನ್ನು ದಿನನಿತ್ಯ ಉಪಯೋಗಿಸಿ
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